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UNIVERSITY OF CALIFORNIA

64



# RABBIT RAISING

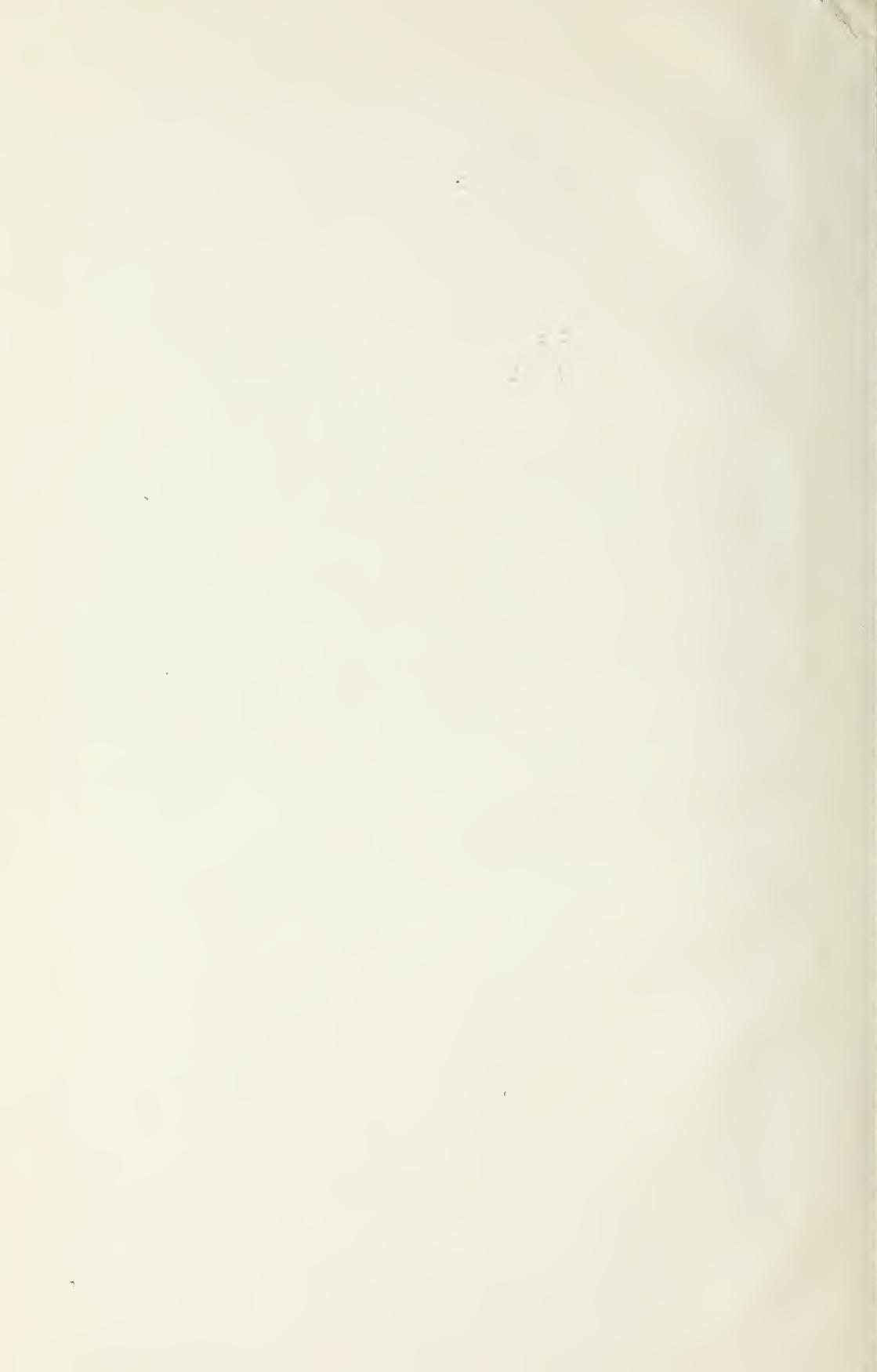
A HANDBOOK

H. M. BUTTERFIELD

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MANUAL 9



# RABBIT RAISING

A H A N D B O O K

**H. M. BUTTERFIELD**

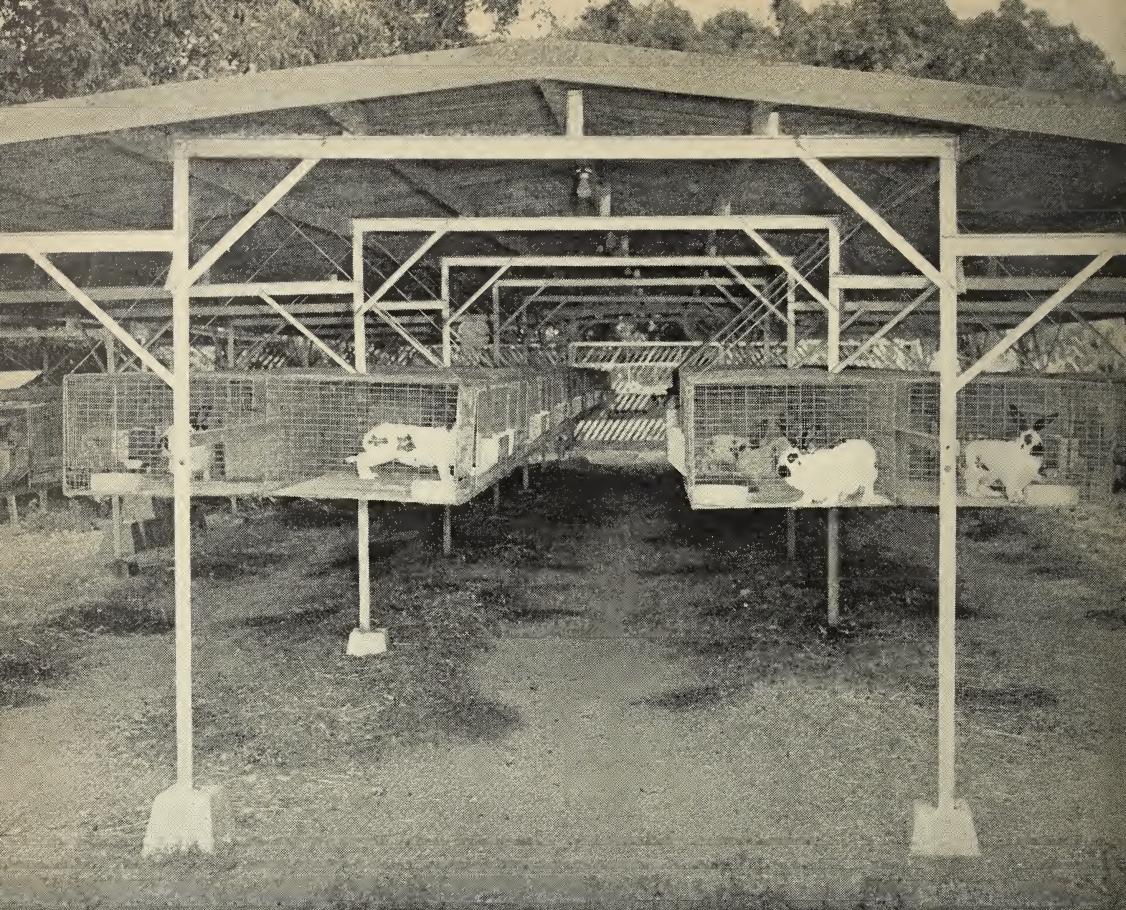
University of California · · · College of Agriculture  
Agricultural Experiment Station and Extension Service

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**This manual replaces Extension Circular 161**



The all-metal hutch is easy to keep clean. Its floor board protects against ground drafts and hock injury.

**The author: H. M. Butterfield is Agriculturist in Agricultural Extension.**

**October, 1953**

# RABBIT RAISING

A H A N D B O O K

H. M. BUTTERFIELD

## RABBIT RAISING AS A FARM ENTERPRISE . . .

**is a comparatively young industry. Its success depends on high consumer demand, easily available market facilities, an equitable climate, and avoidance of beginner's risks.**

**Survey of state.** Almost 10 per cent of the rabbit farms in the United States are in California. More than 30 million live rabbits are sold annually; in Los Angeles County alone the annual sale of rabbits has amounted to more than 600,000 in recent years and occasionally to more than 800,000. The gross income from this leading county has fluctuated from year to year but is usually more than \$4,000,000.

**Rabbit farms.** The 1950 United States Census reports that 13,137 farms in California had rabbits on hand or kept rabbits in 1949. This represents almost 10 per cent of the rabbit farms in the United States.

**Sale valuation.** Sale of rabbits and their products is even more impressive than the number of rabbit farms. The importance of the rabbit industry is indicated by the estimated production figures for Los Angeles County as released by the Los Angeles County Livestock Department. Since 1943 the number of rab-

bits in Los Angeles County has exceeded 600,000 each year, with an estimated value varying from \$1,657,112 in 1943 to \$2,967,950 in 1945. In 1950 the estimated value was \$995,500; in 1951 it was \$949,500. The gross income to rabbit raisers within Los Angeles County amounted to \$9,620,362 in 1946. With a decline in prices since then, the gross income amounted to \$4,368,750 in 1950 and to \$4,415,250 in 1951.

The 1950 census figures may not cover all California rabbit raisers; however, the relative importance of rabbit production in leading counties, as reported in the 1950 United States Census, is shown in table 1. Note that Alameda, Humboldt, Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties reported a total value of well over 2 million dollars worth of rabbits and rabbit products, or more than 80 per cent of the state valuation. Each of these seven counties reported a rabbit valuation of more than \$100,000. Adding the counties of Butte,

Table 1. LEADING COUNTIES IN RABBIT PRODUCTION\*

County	Rabbit farms	Value of products
Over \$100,000 in total value		
Alameda.....	362	\$ 137,499
Humboldt.....	235	108,994
Los Angeles.....	1,199	1,097,370
Orange.....	375	195,293
Riverside.....	549	100,314
San Bernardino.....	689	201,569
San Diego.....	781	292,381
Total for above counties.....	4,190 (31.9%)	\$2,133,420 (81.34%)
Over \$25,000 but under \$100,000		
Butte.....	228	\$ 43,316
Fresno.....	804	30,715
Santa Barbara.....	117	82,121
Santa Cruz.....	233	42,934
Sonoma.....	682	42,122
Total for above counties.....	2,064 (15.71%)	\$ 241,208 (9.2%)
Over \$5,000 but under \$25,000		
Contra Costa.....	236	\$ 7,348
Del Norte.....	31	6,439
El Dorado.....	120	12,911
Kern.....	214	9,483
Kings.....	218	7,163
Mendocino.....	180	6,577
Merced.....	451	19,316
Napa.....	115	9,781
Nevada.....	83	7,955
Sacramento.....	513	24,068
San Benito.....	73	7,168
San Joaquin.....	612	15,248
San Luis Obispo.....	203	8,535
San Mateo.....	65	12,624
Santa Clara.....	541	10,012
Stanislaus.....	695	13,839
Tulare.....	464	11,096
Ventura.....	129	18,843
Total for above counties.....	4,943 (37.62%)	\$ 208,406 (7.93%)
Total for other counties.....	1,940 (14.77%)	\$ 39,953 (1.53%)
Total for California in 1950 Census.....	13,137 (100%)	\$2,622,987 (100%)

\* Data from: U. S. Census of Agriculture (California). U. S. Dept. Comm., Bur. Census, v. 1, pt. 33, 1950.

Fresno, Santa Barbara, Santa Cruz, and Sonoma, each of which had rabbits valued at more than \$25,000, it can be seen that the leading 12 counties in California in 1949 reported more than 90 per cent of the state's rabbit valuation.

## CLIMATE

The mild climate in most parts of California is an important asset to the growth of the rabbit industry. In fact, it has made possible the use of the outdoor hutch in almost all districts of the state. True, during inclement weather or in areas of cool or damp climate the outdoor hutch must be protected; but rainfall, which usually is not heavy, is limited almost entirely to the period between November and April.

In the hot inland valleys, heat is a problem. It is not one of the most serious, however, as can be seen by the fact that the United States Rabbit Experiment Station at Fontana is located in a part of the state where summer temperatures occasionally run high, and the fact that of the 12 counties whose rabbit valuation was given, several normally have high summer temperatures. In such areas, special protection for the outdoor hutch must also be provided.

## BEGINNER'S RISKS

The beginning operator who knows nothing about the industry is exposed to many financial risks. Rabbit raising is passing from a side-line enterprise to a principal source of income, with methods of large-scale marketing only partially

worked out. A beginner therefore cannot feel so confident at entering the field as he would poultry production or any other established branch of agriculture.

He needs to be cautious about any type of financial venture not yet proved successful. This is especially true of a venture conducted along with the operation of a rabbitry.

## THREE GROUPS OF RABBIT RAISERS

**Home operator.** Only as many animals are kept on hand by this operator as are needed to supply family requirements. Information about housing, feeding, general care, dressing, treatment of disease, and control of parasites is of particular interest to him. Distribution and marketing are of no concern unless he is selling a few rabbits, either dressed or undressed, locally to friends or neighbors.

**Part-time operator.** Rabbit raising is in addition to the operator's holding an outside job. This operator is concerned with the information needed by the home operator and, in addition, information about the time necessary for operation and the most convenient channels of sale. Efficient production and a steady market are highly important.

**Full-time commercial operator.** The main source of income for this operator is production for the market. He is concerned with housing, breeding, feeding, care, treatment of disease, control of parasites, preparation for market and marketing, and business management.

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Tables on costs and returns are in the section on business aspects of the industry, pages 55 to 62.

## SOURCES OF INCOME . . .

Meat, pelts and furs, wool, and breeding stock comprise the main sources of income. Miscellaneous sources are sale of animals to biological laboratories and sale of manure as fertilizer. Amount of income varies with type of enterprise, and choice of enterprise depends on local demands.

The relative importance of the different sources was almost unknown until supervised records of rabbitries became available through studies of the industry in southern California, conducted by the Agricultural Extension Service of the University of California. The most recent figures on costs and returns used in this manual are based on rabbit cost studies in Los Angeles and San Bernardino counties for 1951.

### MEAT

**High-grade protein.** Rabbit has all the qualifications of a high-grade meat. Tests made by the United States Department of Agriculture show that it compares favorably with other meats as a source of protein (table 2). The meat of young fryer rabbits usually contains less fat than mature beef.

**Compared with beef.** Its relative protein value compared with beef when tested at the United States Rabbit Experiment Station at Fontana was found to be 93 per cent digestible, with no significant difference in comparison with beef. Its tenderness by cooking was tested by the United States Bureau of Home Economics. A rabbit cooked 1 hour and 15 min-

utes was found to be more tender than a chicken cooked 2 hours and 30 minutes.

**Packaging and price.** Since rabbit meat furnishes a high-grade protein, its future production depends very largely on demand. If demand is to remain dependable or to increase, the meat must be readily available in appetizing form and at economical prices. Much progress has been made in recent years in attractive packaging and availability of rabbit meat.

**Marketable rabbits to a litter.** An efficient operator should be able to average more than five marketable rabbits to the litter. It must also be remembered that some of these young fryers must be retained for replacements of the breeding stock in the rabbitry. The results of the records of the rabbitries coöperating in the 1951 Rabbit Cost Studies in Los Angeles and San Bernardino counties appear in table 3.

### PELTS AND FURS

Although the terms *pelts* and *furs* are often used interchangeably in statistical reports of the industry, rabbit pelts ordinarily consist of butcher-run and haters' pelts. Butcher-run is the term used

Table 2. COMPARATIVE COMPOSITION OF RABBIT MEAT AND BEEF\*

Kind of meat	Percentage dry matter	Percentage protein (N. $\times$ 6.25)	Percentage fat (ether extract)	Percentage minerals	Calories per gram
Rabbit . . . . .	40.2	30.8	7.0	1.6	200
Beef . . . . .	42.4	30.3	10.8	1.3	220

\* Tests reported by Dorothy B. Darling and Hugo W. Nilson of the Fish and Wildlife Service, United States Department of the Interior.

Table 3. AVERAGE MARKETABLE RABBITS TO LITTER AS SHOWN  
IN RABBIT MANAGEMENT STUDY FOR 1951

	10-year average, 1930-39	6-year average, 1945-50	Average, 1951
<b>Los Angeles County</b>			
Number of kindlings.....	3.2	3.9	4.7
Number raised per doe.....	16.7	23.3	28.0
Average selling weight.....	3.9	4.4	4.2
<b>San Bernardino County</b>			
Number of kindlings.....	....	....	4.0
Number raised per doe.....	....	....	25.2
Average selling weight.....	....	....	4.0

Note: Costs and returns on rabbit meat are discussed under "Business Aspects of the Industry," on page 55.

for the pelts skinned from rabbits raised for meat; their quality varies according to breed and to treatment after skinning. Hatters' pelts comprise the least desirable of all pelts. Rabbit furs, on the other hand, usually indicate the fine-quality fur pelts from animals especially bred for their fur.

**Pelt imports high.** Under normal conditions, the United States imports a large number of rabbit pelts, chiefly from

Australia, New Zealand, France, Belgium, and England (table 4). Imports make up possibly 98 per cent of the pelts used in this country. During 1936 to 1939, inclusive, almost 19 million pounds of undressed rabbit pelts were imported at a yearly value of \$13,965,800. Imports for 1945 to 1951, inclusive, averaged more than 21 million pounds, valued at more than \$17,800,000. In addition, more than 4½ million undressed hare pelts

Table 4. IMPORTS OF UNDRESSED RABBIT AND CONEY AND HARE PELTS FOR THE  
YEARS 1935 AND 1936, AND 1945 TO 1951, INCLUSIVE

Year	Rabbit and coney pelts (undressed)		Hare pelts (undressed)	
	(dollars)	(pounds)	(dollars)	(number)
1935*.....	\$13,973,303	32,291,879	\$ 775,736	2,519,834
1936.....	20,921,056	21,392,369†	1,329,959	8,686,378
1945‡.....	19,477,878	21,169,812	3,392,737	2,242,426
1946.....	33,295,651	26,442,642	5,502,655	3,013,740
1947.....	21,614,506	19,406,013	9,766,428	5,688,832
1948.....	22,747,009	23,720,924	3,409,878	7,020,099
1949.....	8,384,933	17,221,203	2,556,895	6,344,723
1950.....	10,200,857	22,488,931	1,692,352	5,574,040
1951.....	9,080,291	17,979,104	899,774	1,689,863

\* Years 1935 and 1936 from Foreign and Domestic Report of U. S. Dept. Comm.

† Weight estimated on basis of 128,354,214 pelts.

‡ Years 1945 to 1951 from report No. Ft. 110, General Imports of Merchandise, U. S. Dept. Comm.

were annually imported in the 1945 to 1951 period at a value of more than \$3,800,000 a year. Undressed rabbit pelts are admitted into the United States duty free.

**Income from pelts.** These figures have given the impression that the average rabbit raiser has a bright outlook in the sale of rabbit pelts to meet the great demand. This is not true. The California Enterprise-Management studies, conducted by the Agricultural Extension Service, show that a very small percentage of the total income in rabbit raising is from pelts. According to a mimeographed report of the Agricultural Extension Service, Los Angeles, 1951, income from hides, manure, et cetera in Los Angeles County for 1951 amounted to only 1 per cent of the total income of \$36.82 per doe. Rarely has the individual rabbit raiser exceeded this amount.

It is often impractical for a producer of meat rabbits to keep the pelts—for instance, if he is a large producer who sells rabbits alive to be dressed in central killing plants in the larger cities. The small, side-line operator who markets direct, however, can easily handle the pelts; in fact, the pelt income, no matter how small, is important to his management program.

Domestic producers need to know approximately what per cent of the American demand for pelts can be supplied by the domestic industry. Presumably they have a long way to go before they can meet this demand. Still more important is the question of whether or not they can equal the quality of the best imported pelts and still show a profit. All points therefore indicate that the income from pelts should not be ignored by the beginner, but that it should not be overestimated.

**Furs and special breeding.** In fine rabbit-fur production, California supplies some of the best furs received on eastern markets. To achieve this, however, special attention has been given to breeding,

which may influence fur quality more than feeding or climate. In addition to the White New Zealand and Californian rabbit, certain light-weight breeds, such as the Chinchilla and the Castor Rex or its crosses, have been developed to meet this need. Operators who have specialized in the breeding and proper handling of high-quality furs are receiving prices well above the average, but recent prices for pelts have been very low. In southern California, 1952 quotations mentioned a price of 20 cents for large No. 1 white doe pelts, 15 cents for white light buck pelts, and 10 cents for No. 2 white doe pelts and for colored pelts of does and bucks. Pelt prices offered in northern California were up to 25 cents for large No. 1 white doe pelts and 18 cents for white light buck pelts.

Butcher-run white pelts were quoted at 45 to 55 cents a pound, and colored butcher-run pelts at only 10 cents a pound. Needless to say, there can be little profit in the butcher-run pelts at such prices, and the price for No. 1 white doe pelts would hardly justify specializing in pelt production. Where rabbits are being dressed at home, the pelts should be saved and sold for whatever they will bring, even when the price is low.

**Income from furs.** Each prospective fur producer should study the markets in relation to his own abilities before estimating possible income from the sale of furs. It is definitely not a field for the beginning operator, and even the experienced operator should realize that the operation of a rabbitry for pelt or fur production alone is not practical except by special breeding.

## WOOL

**Examine field carefully.** A survey by the American Angora Rabbit Breeders' Association several years ago indicated that California led all other states in the raising of Angora wool rabbits. This marked interest may be traced in part to certain advertising which empha-

sized the possibility of high returns. Here and there some breeders may have secured high returns from Angora wool, but at the present time there are very few wool producers in California. This is a good indication that little or no money can be made by raising Angora rabbits. The prospective operator needs to look into this field very carefully before entering it.

Yields of wool depend on the strain and the care of the individual animal. Breeders speak of 8-ounce woolers and 16-ounce woolers, meaning rabbits producing that many ounces in a year. An average of 1 pound of wool a year is a possibility being reached by efficient producers, but 12 to 14 ounces for a mature rabbit are very likely well above the average in most rabbitries.

More accurate records are necessary to show what can be expected in the specialization of Angora wool. Any increase in its production should be accompanied by market development. A limited number of animals may be sold for breeding, but the most important problem is to find a market for the wool or yarn at prices notwithstanding competition of imported rabbit wool. The import of Angora rabbit wool quickly affects prices on the American market. The imports for American consumption from 1949 to 1951 are shown in table 5.

**Income from wool.** The income from wool alone may not be sufficient to cover cost of production, even though all records available indicate that Angoras show a lower feed cost and lower average hours of labor per doe than any other breed. If raising Angora wool rabbits is planned, capitalize on all outlets of sale—meat, breeding stock, and wool.

Late in 1952, quotations from the American Angora Breeders' Coöperative of Palmer Lake, Colorado, were as follows:

	Exchange value*	Cash advances
No. 1 plucked or super	\$8.00	none
No. 1 clipped	7.00	\$3.50
No. 2 plucked	7.00	none
No. 2 clipped	6.00	3.00
No. 3 clipped	5.00	2.50
No. 4 clipped	2.00	2.00
No. 5 clipped	1.00	1.00

#### BREEDING STOCK

**Specialist's field.** For many years the rabbit raiser with an established reputation for dependable breeding stock has secured a good income. In exceptional cases, breeding stock made up about 70 per cent of the sales. The beginner, on the other hand, who has not yet estab-

\* Exchange value means exchange of wool for merchandise, such as cloth, sweaters, yarn, et cetera.

Table 5. UNITED STATES ANGORA RABBIT WOOL (HAIR) IMPORTS FOR CONSUMPTION

Year	Greasy wool		Washed wool		Sorted wool		Scoured wool	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1949....	5,097	\$27,931	9,870	\$ 58,358	97	\$ 540	115,227	\$614,490
1950....	7,318	12,812	24,586	111,156	572	1,865	102,985	510,932
1951....	164	1,000	13,364	24,231	15,424	51,947	43,103	203,557

Note: Some Angora wool yarn was also imported. Most of the imported Angora rabbit wool comes from Japan and France, with small amounts from other countries.

lished a reputation for producing good breeding stock, and others who do not attempt to keep purebred animals will probably not secure an adequate income. And, judging from sales reported, the average rabbit raiser secures only a small percentage of his total income from breeding stock.

**Average sales income.** The income from the sale of breeding stock in Los Angeles County for 1951 averaged about 2 per cent of the total income of \$36.32 per doe. In San Bernardino County for the same year, the breeding stock sold was valued at 66.3 cents per pound, as

compared with 29.4 cents for fryers and 14.7 cents for old meat animals.

### MISCELLANEOUS SOURCES

There are very few additional sources of income in rabbit raising. The most important is sale of manure as fertilizer. A few animals are sold to experimental laboratories, and to biological laboratories for use in tests for pregnancy.

Rabbits are also sold as pets, a practice frowned on by most commercial rabbit meat producers who consider the sentiment associated with pet rabbits a great drawback to the sale of rabbit meat.

## FANCY STOCK FOR EXHIBITION . . .

These animals need about the same care as ordinary utility rabbits, with special attention to fit them for exhibit.

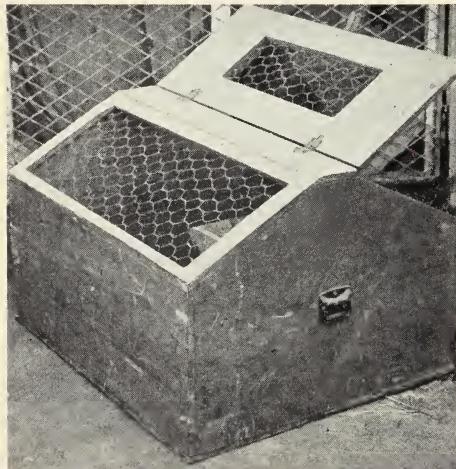
If a rabbit raiser wants to combine fancy stock with utility, he needs to know something about the care and management of fancy stock. Special publications on the exhibition of rabbits at shows have been published; these can be secured from some of the public libraries or bought direct from the publishers.

**Choosing the breed.** A good utility rabbit for meat and high-quality fur may also be a good fancy rabbit. There may

be some difference between the two standards; yet, in a general way, there is close agreement. The best purebred rabbit can be made to adhere very closely to the fancy standard and, at the same time, meet all normal requirements for meat, fur, or, with Angoras, wool. If a rabbit is not a purebred, even though it is capable of meeting the demand for meat, fur, or wool, it is excluded from sale as a fancy breeder, or from receiving prizes and exhibition publicity.

Many rabbit raisers prefer to start with animals eligible for registry and meeting the standard either for utility or for fancy stock. There is some ground for selecting the pedigreed rabbit even for utility purposes. It takes several generations of systematic breeding to meet the normal standard. The young of pedigreed rabbits are usually uniform in weight, time of maturity, color of fur, and other factors that are of vital interest to the utility rabbit breeder.

**Disqualifications.** Even defects that in no way interfere with sale for utility purposes must be overcome for the show. If a rabbit is not near maximum age at the time of the show, it stands a very poor chance of winning unless it is exception-



A rabbit will seldom suffer injuries or suffocation in this type of carrier.

ally strong in such points as color and shape. Nurse does are sometimes used to assist in securing maximum size for age when young rabbits are to be exhibited.

It is a good practice to visit rabbit shows and become familiar with the methods usually followed in judging. These shows are of great educational value to both rabbit fanciers and utility breeders. They call for organization among breeders, and the contact between members and the public helps to increase production and sale of rabbits and rabbit products.

**Carriers.** Fancy rabbits and rabbits sold as breeding stock are shipped in the type of carrier shown on page 8. Pack-

ages cannot be easily stacked on this type of case, so the animals are assured plenty of air. If the owner is exhibiting only one rabbit and plans to carry it, he may prefer a lighter carrier with a hand grip on top.

The carrier must be well ventilated, and should be cleaned regularly to help prevent such diseases as coccidiosis. Place only one rabbit in a compartment; two may fight and injure each other. Carriers must be of ample size and bedded with straw to keep the fur coat from being soiled. A little feed may be enclosed if necessary. Where a breeder takes his animals to the show by automobile, feed and water seldom are necessary en route.

## **HOURS OF LABOR REQUIRED TO OPERATE A RABBITRY . . .**

The minimum time required for operation has gradually decreased down through the years as labor-saving equipment has been installed.

**Minimum hours.** The 1951 Enterprise Management studies in San Bernardino County showed an average of 5.9 hours of labor per doe, with one rabbitry reporting 2.7 hours of labor per doe. Los Angeles County showed an average of 10.7 hours per doe in 1951 and 9.5 hours in 1952. Since labor amounted to 29 per cent of all costs in Los Angeles County for 1951 and amounted to 8.8 cents per pound out of a total of 29.9 cents total cost, it is easy to understand that greater efficiency in the use of labor can affect profits very materially.

**Efficiency and greater production.** At the present time one operator is able to care for more does than has been possible in the past. This point of achievement has been brought about principally by the development of such labor-saving items as bulk feed and pellet feed, and by such devices as feeders to be attached to the outside of the hutches and automatic watering systems.

This increased ability to care for more

does has given the efficient rabbit raiser an opportunity to increase production. On the most efficiently operated rabbit farms more than 100 pounds of live fryer rabbits are now produced for each breeding doe. This higher rate of production has been made possible in part by the many labor-saving devices and routines which have reduced the number of hours of labor per doe; and in part by the use of aureomycin and vitimin B<sub>12</sub> to reduce mortality among fryer rabbits up to the age of two months.

**Efficiency and total cost.** Increased efficiency in the use of labor has not been sufficient to offset increased total cost (see "Business Aspects of the Industry," page 55). The average labor cost for the ten years 1930 to 1939 was 6.9 cents per pound, as compared with 8.8 cents per pound in 1951 for Los Angeles County. In San Bernardino County in 1951, the labor cost was reduced to 5.4 cents per pound, as compared with 8.6 cents for 1950.

## THE RABBITRY . . .

This consists of the hutches and often, as in large rabbitries, a shelter of sufficient size to hold all the hutches as well as a storage unit for quantity amounts of feed.

### CONSTRUCTING THE HUTCH

**Build for convenience and permanence.** A well-built hutch is economical to operate and easy to keep sanitary. Dark hutches that leak and are cold and drafty will cause the breeder serious trouble. He will not be able to raise his stock successfully nor to sell it to advantage.

**Provide ventilation.** Fresh air must reach the inside of all hutches, especially those in which young rabbits are developing. Rabbits raised in clean, well-ventilated hutches are seldom affected with respiratory diseases.

**Keep hutches clean and dry.** It is vitally important to keep the hutches clean and dry at all times. Protect them from rain and from leaks in the watering or cooling systems. If this is not done, diseases will appear.

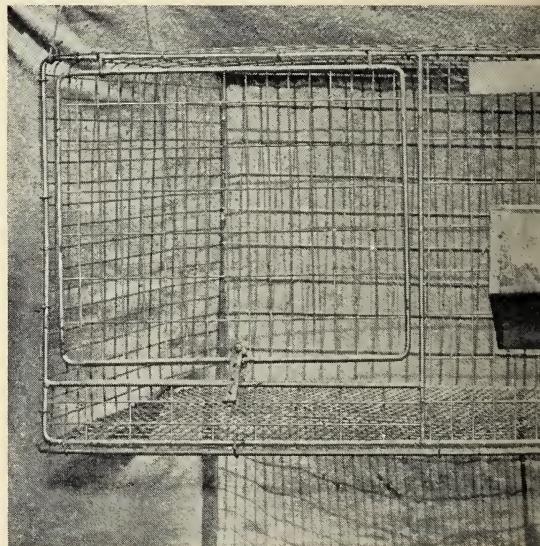
**All-metal hutch.** Many types of rabbit hutches have been tested and many types are still in use. Most authorities now agree that the all-metal hutch is superior to any other type because it can easily be kept sanitary. The more modern rabbitries are being constructed almost entirely of metal, including the hutch. The all-wire hutch furnishes a maximum amount of light and air as well as a maximum degree of sanitation. In a cold climate or in winter, however, if the hutches are located in an open shed, the wire floors should be protected, at least partially, with linoleum bedded with straw, or with 1 inch slats spaced no more than  $\frac{5}{8}$  inch apart, these also bedded with clean straw. These floor coverings must be kept scrupulously clean.

**Wood and wire hutch.** Even though the all-metal hutch is the most practical, the wooden hutch with hardware-cloth floor and wire sides is still used to some

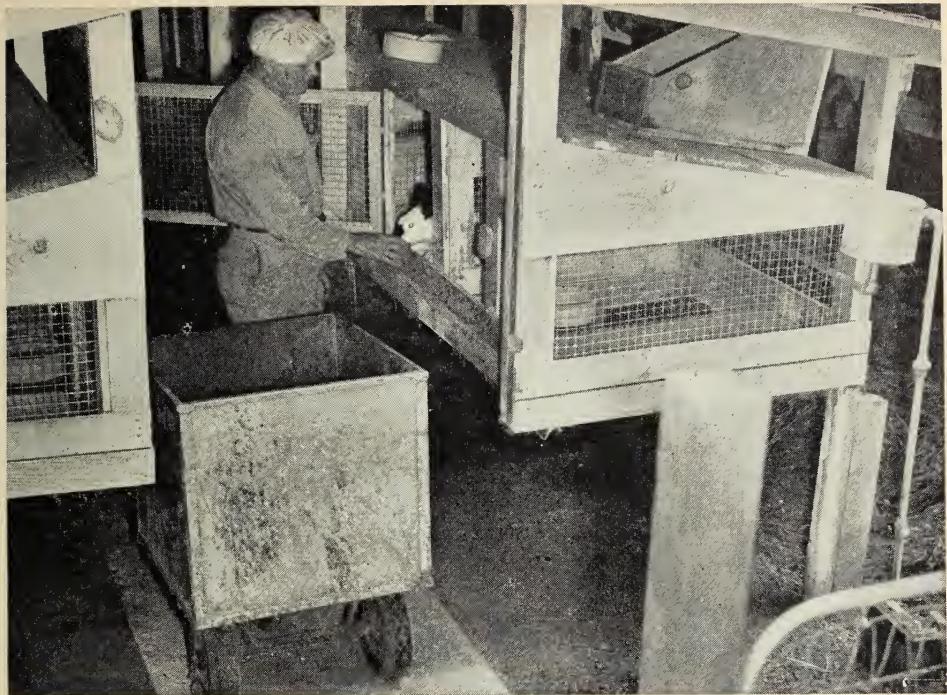
extent. One specimen found to be fairly satisfactory in earlier years at the College of Agriculture at Davis is pictured on page 11. Rabbit raisers who do not feel that they can afford an all-metal hutch may wish to construct one of these wood and wire hutches.

Sometimes a youngster who becomes interested in raising rabbits tries to convert a wooden box into a hutch. Wooden boxes cannot be made over into satisfactory hutches, so when a child becomes interested in raising rabbits encourage him to study hutch plans, then help him build the hutch.

**Hutch height.** Many commercial rabbit raisers now prefer hutches built only one tier high. Roomy, single-tiered hutches are considered the easiest to keep sanitary. If land is not too costly the slightly greater expense of single-tiered hutches may be more than offset by the



The all-metal hutch offers many conveniences: ease of cleaning; feeder is outside; the door



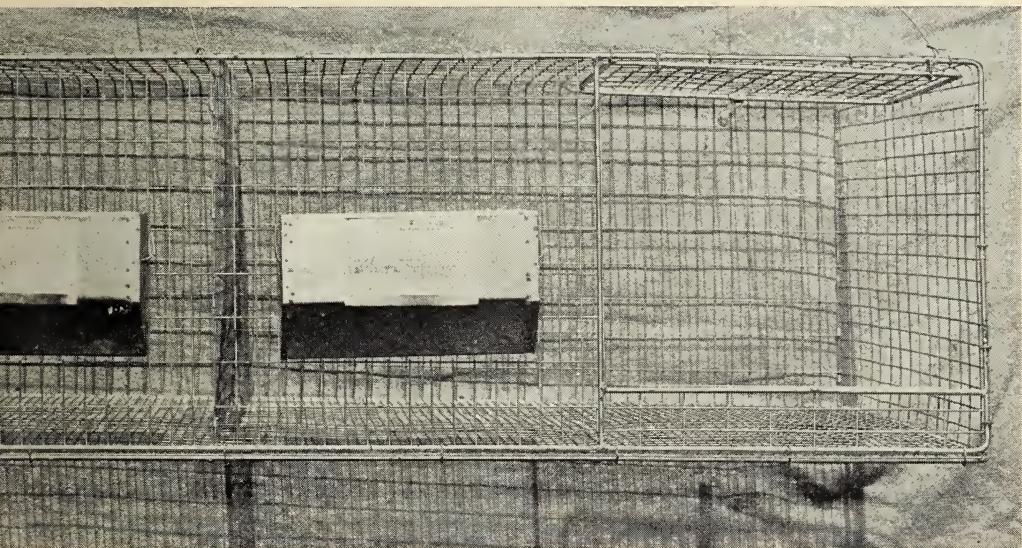
The wood and wire hutch is still used by many rabbit raisers.

reduced amount of maintenance of the rabbitry.

**Standard dimensions.** The standard

hutch compartment measures 4 feet long by 2.5 feet deep by 1.5 feet high.

**Floors.** The so-called self-cleaning



swings up and in, allowing easy access; back of feeder is slotted to accommodate hutch record card. Wire floor should be partially covered with other material during cold weather.

floor is in approximately 98 per cent of the rabbitries in southern California, and is popular everywhere. It is usually made of  $\frac{5}{8}$ -inch hardware cloth—also called fruit-drying cloth—or from  $\frac{1}{2} \times 1$ -inch welded wire. Both types of floors have caused some difficulty: they are hard to keep clean and they cause sore hocks. A new type of wire— $\frac{5}{8} \times 1$ -inch mesh—is now being tried. It is available at present from only one dealer in San Fernando Valley. Wire with a rectangular mesh  $\frac{1}{2}$  inch wide by 1 inch long is also in use. This type of floor not only reduces the hours of man labor per doe per year but also makes the control of disease easier.

A slatted floor is very hard to keep clean. A solid floor with hardware cloth covered toilet in the back is partially self-cleaning. This floor is satisfactory only when kept clean and dry. Smooth, perforated metal has been tested at the United States Rabbit Experiment Station at Fontana with good results, but it is rarely available. Unless local conditions require some other material, most rabbit raisers will find the standard, smooth, galvanized hardware cloth of  $\frac{5}{8}$ -inch mesh—or the  $\frac{1}{2} \times 1$ -inch wire mesh—most satisfactory. If this is not available, substitute 1-inch-square wooden slats, spaced no more than  $\frac{5}{8}$  inch apart, but keep the floor as dry and clean as possible. If a floor has a rough surface, place a slatted stand or flat board at one end where the rabbit may rest. This will help to prevent hock injury.

**Toilets.** If possible, avoid building hutches that require special toilets. If a solid floor is laid, then plan for a toilet pan in each hutch.

Where a single hutch stands over a dirt or a concrete floor, no pan is needed beneath the toilet opening. Concrete floors are not so satisfactory as dirt floors. Odors on a hot day and heat reflection are the objections. There is more absorption with dirt.

**Walls.** The two opposite ends of the wooden double-hutch compartment are

usually boarded solid, with a V-shaped feeder in the middle, where the rabbits can be fed chopped hay or given concentrate feed in a drawer feeder. The door in front and the back walls are covered with wire netting. In a cool climate a 10-inch board is placed at the back to give some protection or, if necessary, the entire back wall is boarded in. The all-wire hutch compartment does not stand on a wooden framework as does the wooden hutch.

All hutch compartments, whether wire or wood and wire should be kept within a shelter or, in cold climates, placed in a house for adequate protection.

**Roofs.** The wooden hutch usually has a solid roof. Set the roof boards to form a 6- to 8-inch overhang in front and slope them downward to a 2-inch overhang at the rear. Cover the board roof with rain-proof roofing material to make the hutch leakproof. The wire hutch built with a roof needs no separate roof when only one tier high.

**Doors.** The door of a wooden hutch should extend the full width of the hutch. Fit the outer-end cleats of the door snugly over the edge of the flooring at the bottom to act as door stops. A door hung in this way is not easily clogged with hay or litter.

There is no special advantage in having a separate door in front of the nest. Odd-shaped doors are costly and unnecessary. Rectangular-shaped doors are the easiest to construct. They can be used with the V-shaped feeder if the space under the feeder is boarded up straight and solid. Where only pellets are fed, the door can overlap the partition between two adjoining hutch compartments. By opening only one door, feed can be placed in two compartments.

Equip each door with strong hinges and easily closed catches. Cover the inside of all wooden-frame doors with  $1 \times 2$ -inch welded wire, which is much stronger than netting. In normal times, welded wire is cheap, durable, and easily

available. It cannot be spread or gnawed by the rabbits, and protects the wooden frame when placed on the inside of the door.

A wire hutch usually has a door that is small, yet is wide enough to admit a nest box or other equipment needed in the hutch. One type of wire door swings inward and upward so that it can be fastened to the roof.

**Costs and specifications.** Lumber and labor costs vary too much for the cost of a hutch to be estimated except in a general way (see "Business Aspects of the Industry," page 55).

Any lumberyard is able to furnish cost estimates on the materials needed or suggest substitutes for unavailable ones. Companies offering all-metal hutches will quote prices. The first cost of the all-metal hutch may be somewhat more than for a wooden hutch, but the annual charge per rabbit for housing figured over a period of years will probably be no more, and may actually be less if the anticipated reduction in mortality is included in the estimate.

**The future hutch.** Some changes in hutch plans have been made in past years, and in the future certain radical changes in design may be needed for simplification and improvement. For example, most rabbit raisers know the square hutch compartment tends to collect manure and hair in the corners where the rabbit never walks. The United States Rabbit Experiment Station at Fontana is testing a novel, rounded hutch compartment made of galvanized wire. The sides are fastened to the wire floor, and the floor is supported by wooden strips running lengthwise of the row of hutches. Another compartment type is rectangular, with rounded corners which prevent manure and hair from accumulating since the rabbit walks on the entire floor. Still another design shows an opening in the top of each hutch compartment, but this type of entrance should be improved.

Another change in design is the use of

a 5-gallon can feeder, set in the space between alternate hutches to serve two adjoining hutches. Feeders that are attached to the door or side of the hutch beside the door are also very widely used. Some of these feeders extend over two hutches with a divider between for easier feeding. These conveniences reduce labor largely to keeping pelleted feed in the feeders for the young rabbits being raised for breeders. Still more changes in hutch design may be needed to reduce labor further and yet maintain the health and rapid gains of the rabbits. Automatic watering devices are also being used quite successfully in modern rabbitries.

## CONSTRUCTING THE RABBIT SHELTER

Operators of large rabbitries often roof the area housing the hutches. This structure is called the rabbit shelter. Some modern rabbitries in California are constructed entirely of steel except for a roof of wood or corrugated aluminum sheeting. In other rabbitries the hutches are partially wooden and are suspended from the roof. It is usually not advisable to have supports beneath the front of the hutches; they tend to block the manure that falls through the wire floors, which interferes with adequate cleaning.

Concrete may be used for the entire floor of the rabbitry or for only the alleyway between hutches, as shown in the accompanying illustrations. Many rabbit raisers now prefer soil to concrete for the floor.

Light must reach every hutch compartment. Electric lights should be installed over the alleyway. In most parts of California it is not necessary to wall the rabbitry if the hutches are set back from the sides a sufficient distance so that rain will not reach the rabbits.

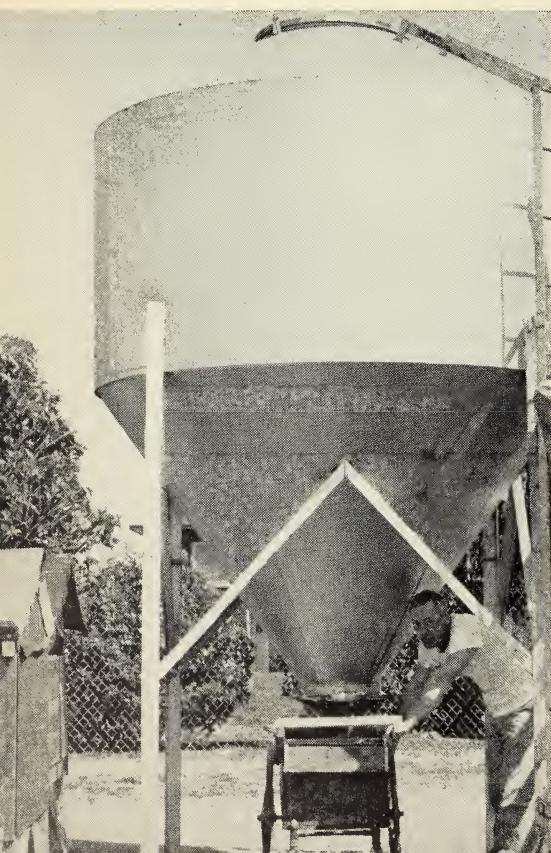
Much labor can be saved by installing self-feeders and an automatic water system. If watering dishes are used, they should be placed in the front corner of the hutch so that water can be turned into



A well-built lath shelter protects against both heat and wind.

the dishes with a hose or with a watering can. Hair and spider webs that tend to accumulate can be removed with a vacuum cleaner or a broom. A blow torch

One of the bulk tank feeders now used on large rabbit farms.



can also be used but it is dangerous and likely to damage the hutch.

The rabbit house should be braced to withstand wind. By fastening the supports to concrete piers, the roof should be held safe in spite of strong winds. If a strong wind prevails, a barrier on the side from which the wind comes may be needed. Windbreaks are needed in most parts of California.

If a separate compartment for feed storage is planned at the end of the house, make it rat- and mouse-proof, and protect it from dogs and cats.

### CONSTRUCTING THE LATH SHELTER

The essential shade in hot climates can be provided by a lath shelter. A properly constructed shelter tends to reduce wind velocity and to lower the temperature. Where the heat is very intense, a solid roof is sometimes laid to accommodate a sprinkling system. However, a solid roof tends to exclude winter sunlight. Burlap sacks hung from the eaves of a lath roof and kept wet will furnish as effective a cooling system for hutches as will the installation of roof sprinklers.

The shelter roof is usually supported by 7- or 8-foot posts. The roof laths should be thicker and much longer than ordinary plaster lath which can be used for the sides. Most operators agree that the spacing between laths should be considerably less than the width of a lath. This provides shade, yet permits entrance of direct sunlight. Lath shelters are usually of permanent construction.

### PROVIDING FEED TANKS

Bulk feed tanks are now used in some of the larger rabbitries. They are constructed of metal or wood. They should stand high enough for a feed cart to be pushed beneath, or even higher to allow the feed to roll down an inclined screen into the cart. Screening the feed separates the powder from the pellets, which process saves cleaning the hutch feeders so often, since rabbits do not eat powdered feed.

## ARRANGEMENT OF HUTCH EQUIPMENT AND CARE OF THE HUTCH . . .

A well-arranged, modern rabbitry requires a minimum amount of labor in the care of its hutches.

### HUTCH EQUIPMENT

**Feed and water containers.** The arrangement of feed and water equipment is shown in the photographs on page 11. Automatic water systems may replace water dishes. If hay is fed, a V-shaped feeder placed between the hutches is considered the best. It is not used if pellets only are fed. Grain and water are placed in earthenware dishes or in specially constructed galvanized-iron feeders or in self-feeders.

Outside feeders attached to the door or to the front of the hutch are becoming quite popular. They come in various sizes, costing commercially about \$1.00 to \$1.50 each. Many types of homemade outside feeders can be found. Some feeders extend past the division between two hutches, thus allowing feed to be placed quickly for two hutches. A divider inside the feeder separates the two hutches.

A drawer feeder that slides in beneath the central V-shaped hay feeder has been used successfully in a number of California rabbitries. It tends to catch loose

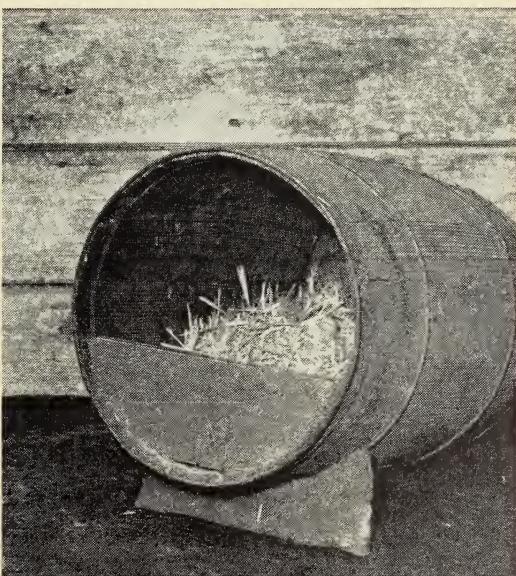
leaves from alfalfa hay and holds grain without serious waste. A projecting shelf under the V-feeder is used similarly.

The drawer is of wood with metal over the front edge to prevent gnawing. If new metal is unavailable, used metal can be smoothed out and substituted. Fasten on small cross-strips to keep young rabbits from getting into the drawer.

**Nests.** A satisfactory nest for the average-sized doe can be 12 inches wide by 12 inches high by 24 inches long. Rabbits weighing more than 10 or 11 pounds may need a longer nest; very small breeds may need less space.

An inexpensive nest can be made from an ordinary apple box,  $10\frac{1}{2}$  inches high by  $11\frac{1}{2}$  inches wide by 18 inches long, inside measurement, with top removed. A solid board only slightly smaller than the box should be placed inside the apple box to be used as a fake bottom covering the cracks. This will prevent chilling of new-born rabbits. A nest box of this size is satisfactory for the average-sized breeds and will serve until the young are

Two satisfactory nests. The advantage of the box nest is in its shelf, where the mother can remain near the babies.



able to jump out over the sides. Its chief drawback is that its construction permits the doe to jump in on the young if she is suddenly frightened.

A box of the same size with the forepart of the top and upper part of the sides removed and the ends beveled off is a slight improvement over the uncovered apple box. All exposed edges should be lined with metal for protection against gnawing. This type of nest would not do in a cold climate.

A nest constructed from a nail keg laid on its side is used at the Fontana Experiment Station. A keg with a head diameter of 13 inches is suitable for does weighing 12 pounds or more; one with an 11½-inch diameter for does weighing from 8 to 12 pounds; and a 10-inch diameter for does under 8 pounds.

Remove the top end of the keg, and nail cleats across the lower half of the opening to confine the young rabbits and

the nesting material. Rest the keg on a stand to keep it from rolling. When the young are about three weeks old, remove the upper cleat so that they can get out more easily. Nailing a smooth metal strip along the surface of the top cleat will protect the wood from gnawing.

Manufacturers of rabbit equipment have available nest boxes with removable bottoms for easier cleaning. Much research remains to be done on the ideal nest box. Many improvements will undoubtedly be seen in the future.

## CARE OF THE HUTCH

**Clean at least weekly.** Keep the hutches dry and clean at all times. It is very easy to become careless in maintenance; the moment carelessness begins, diseases begin. Clean thoroughly at least once a week. Before scrubbing, remove with a scraper or a stiff brush all manure that sticks to the floor.

### Wooden floor or all-metal hutch.

If the hutch has a wooden floor, scrub it with lye water—1 pound of lye to 5 or 6 gallons of water. A disinfectant is not necessary unless some specific infection requires its use. Be certain that the floor dries off thoroughly before returning the animal to the hutch. The all-wire compartment needs very little upkeep. When rust begins to show, sand the wire and spray the entire unit with a good grade of aluminum paint.

**Feed and water containers.** Keep feed and water in clean containers in the hutch, away from manure and urine. Clean the containers frequently and scale them to remove any organic matter that accumulates. Coccidiosis, for instance, spreads almost entirely through soiled feed and drinking water and damp floors (see page 38).

If toilet pans are used, they should be thoroughly scrubbed with a good disinfectant two or three times a week. See that nesting material is kept dry and clean at all times.



This convenient feed carrier holds three sacks of pelleted feed.

## BREEDING . . .

Many breeds are now available for breeding stock. The beginner usually is advised to stock with one breed. The experienced operator, on the other hand, may find that raising several different breeds is profitable. Both operators must be familiar with local market preferences.

## SELECTING THE BREED

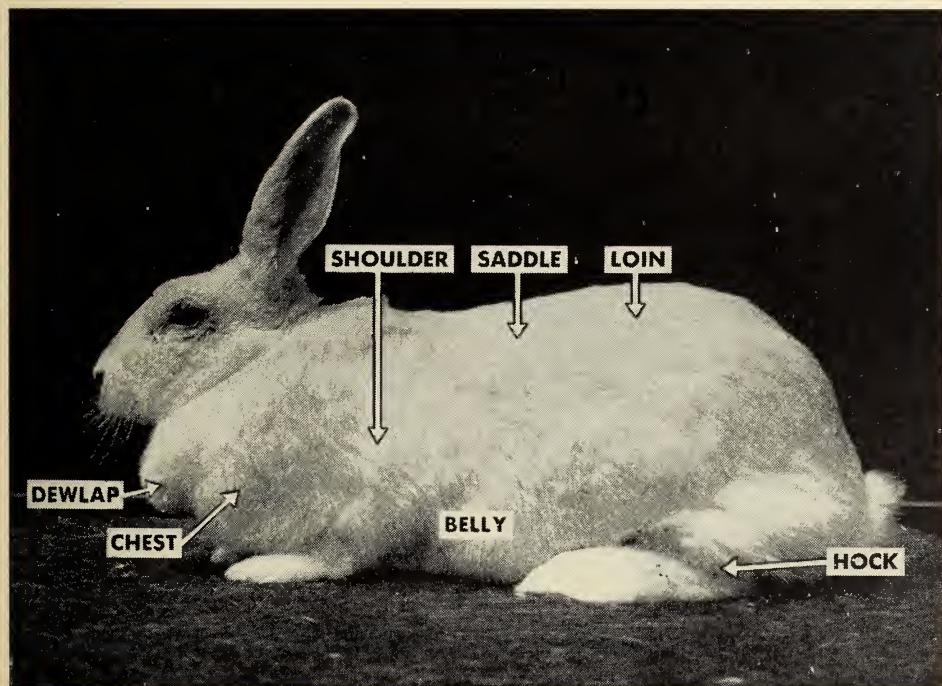
A prospective producer familiar with local conditions will know what rabbits satisfy market demands and what rabbits do not. For example, if a market prefers fryers weighing from 1½ to 2 pounds dressed or 3 to 4½ pounds live weight, a breed that develops early and quickly reaches marketable weight at a low feed cost should be chosen. If a market prefers meat rabbits weighing 5 pounds or more, breeds that are slow to develop or do not fill out well when young are preferable.

Nearly all producers raise white rabbits almost exclusively because colored furs are discounted except for local use

in making fur garments. White pelts, on the other hand, can be dyed any color the manufacturer chooses.

The few breeders catering to a fur market sell the meat from the rabbits producing the fur for whatever it will bring. The meat from a 6-months-old fur rabbit will usually weigh 4 or 5 pounds or more. Dressed rabbits of this size are usually low priced, and it is important to find a market willing to take them.

Many breeds are now available for breeding stock. Newer breeds usually sell for more than old established breeds, but the beginner should anticipate a drop in prices for high-priced new breeds. The



The rabbit raiser soon learns the names of the principal points of animal anatomy.

final choice in breeding stock will nearly always depend on the value of the animals for both meat and fur, since a new breed of excellent fur qualities may have no market value because pelts are not available in sufficient numbers for matching.

The comparative popularity of various breeds can be seen at commercial rabbitries and at rabbit shows. The shows especially illustrate how closely producers are approaching the ideal standard given in "The Guide Book and Standard" of the American Rabbit Breeders' Association.

A knowledge of this standard is essential whether a beginner hopes to exhibit or not. Table 6 includes the important breeds and their primary utility values. Fanciers may find more than one standard for some breeds. If so, it is fairly safe always to follow the standard recognized by the oldest specialty club for the breed in question.

**Breed description terms.** These are defined in a glossary in "The Guide Book and Standard" already mentioned. The photograph on page 17 has a few terms that may be useful in understanding some of the descriptive points discussed here.

**Breeds for the beginner.** It is best to start with only one breed. To learn the characteristics and requirements of one breed is naturally less confusing than to learn those of several breeds. With experience and a developed market, it may be profitable to raise several different breeds to cater to different demands.

Among the meat rabbits, White New Zealand, Californian Rabbit, Red New Zealand, and Champagne d'Argent are very popular for their high-quality meat. Among the fur rabbits, Standard Chinchilla, American Chinchilla, White New Zealand, White Flemish Giant, Havana, Lilac, Castor Rex Satin and its crosses, and certain blue and silver breeds are very popular for both fur and high-quality meat. Since all of these breeds are produced in quantity, stock is usually easy to purchase. In this way the market demand is readily met.

Some of the newer breeds might become more popular if they could be secured in larger quantities and at less expense. Introducing a little-known breed is not always a profitable undertaking. The photographs on pages 19 and 21 show some of the popular breeds.

**Practical versus fancy stock.** The beginning breeder should start with utility rather than fancy stock. He is not yet ready to cope with the exhibition requirements of fancy stock. He should buy from breeders whose records show at least three generations of high production in the ancestors.

**Choosing individuals.** Regardless of breed or variety, certain general characteristics affect the choice of breeding rabbits. These are:

Ability to maintain health and vigor under commercial conditions; not unduly susceptible to disease.

Meat white, fine grained, firm, and delicately flavored, if meat rabbits.

Dressing percentage high, with a large percentage of the best meat cuts (saddle); body compact and meaty with fine bone for the meat trade.

Ability to thrive on inexpensive feed.

Market weight and desirable plumpness reached at an early age.

Value sufficient to make the business profitable under existing conditions.

Able to reproduce true to color and type.

A good breeder the year round and able to continue as a good breeder for at least two to three years.

Females good mothers, able to bear and rear large litters, with at least 25 rabbits to fryer size each year (a minimum of 110 pounds of meat, live weight).

Does should be heavy milk producers. Records should show stock free from inherited faults, such as buck teeth, woolies, et cetera, and uniformly satisfactory as to type.

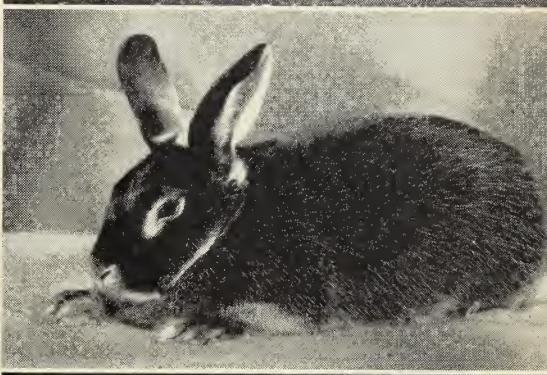
The Californian Rabbit is a cross between the Himalayan and the White New Zealand and the Chinchilla, with markings of the Himalayan.



Here are the Himalayan markings which are so apparent in the Californian Rabbit.



The black fur of the Silver Black Marten is shot with silver. This is a show and fur animal.



The White Angora is raised primarily for its abundant wool.



The American Checkered Giant is raised for both meat and show.

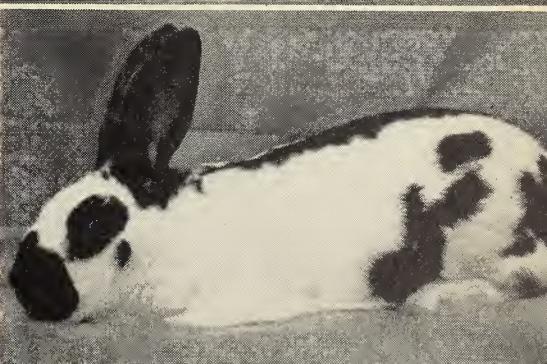


Table 6. STANDARD BREEDS AND VARIETIES OF RABBITS IN EFFECT APRIL 1, 1950\*

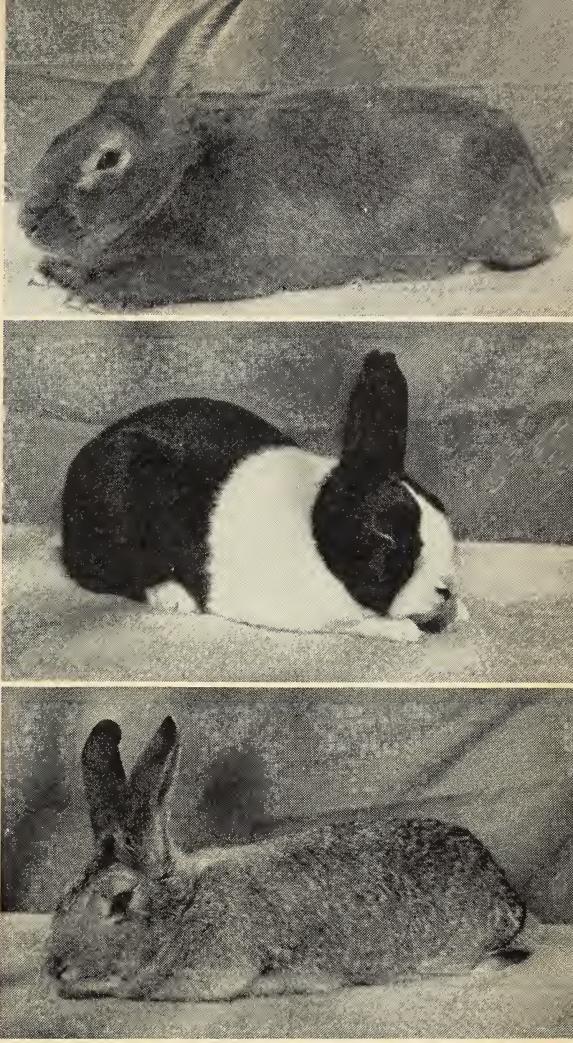
Breeds and varieties	Ideal standard mature weight in pounds		Registration weight in pounds		Primary utility value
	Buck	Doe	Buck	Doe	
American (Blue and White)†	9	10	8-10	9-11	Meat, fur, show
American Chinchilla	9	10	8½-11	9-12	Fur and meat
American Giant Chinchilla	13-14	14-15	12-15	13-16	Fur and meat
American Standard Chinchilla	6½	7	6-7½	6½-8	Fur and show
American Sable	8	9	7 up	8 up	Fur and show
American Silver Fox (Black and Blue)	9	10	8-11	9-12	Fur
Angora Woolers (English)	6 up	7 up	5½-7½	5½-8	Wool
Angora Woolers (French)	8	8	7 up	7 up	Wool
Belgian Hare	8	8	6-9	6-9	Meat and show
Beveren (Blue and Black)	9½ up	10½ up	7½ up	8½ up	Fur
Beveren (White)	9 up	10 up	7 up	8 up	Fur
California	9	9½	8-10	8½-10½	Meat
Champagne d'Argent	10	10½	9-11	9½-12	Fur and show
Checkered Giant	11 up	12 up	10 up	11 up	Meat and show
Creme d'Argent	8	9	7-9	8-10	Fur, meat, show
Dutch (Black, Blue, Gray, Steel Gray, Tortoise, and any other color)	4½	4½	3-5½	3-5½	Show
English (spots any color)	6-8	6-8	Not over 8	Not over 8	Show
Flemish Giant (Steel Gray, Light Gray, Black, Fawn, Sandy Gray, White, and Blue)	14 up	15 up	12 up	13 up	Meat, fur, hatters' pelts, show
Havana Heavyweight	6	6	7 up	7 up	Fur and show
Havana Standard	6	6	5-7	5-7	Fur and show
Himalayan	3½	3½	2-5	2-5	Show and fur
Lilac	6½-7	7-7½	5½-8½	6-9	Fur and show
Lops (English and French)	10 up	11 up	Not under 9	Not under 9	Show
Marten (Chocolate)	7½	8½	6-8½	7-9½	Fur and show
Marten (Silver Black and Blue)	7½	8½	6-8½	7-9½	Show and fur

Marten (Silver Sable).....	7½	8½ 11	6-8½ 9-11	7-9½ 10-12	Show and fur Meat, show, hatters' pelts Show and fur
New Zealand (Red and White)—seniors only.....	10	2½-2¾	Not over 3½	Not over 3½	
Polish (White, Blue-eyed White, Black, and Chocolate). Rex (Beaverrex, Blackrex, Bluerex, Castorrex, Chin-chillarex, Havanarex, Lilacrex, Lynrex, Opalex, Redrex, Sealrex, Siamese Sablierex).....	7½ 10	8½ 11	6-8½ 9-11	7-9½ 10-12	
Satin (Chinchilla).....	Not under 7	Not under 7½	Not under 7½	Not under 7½	
Satin (White).....	9½	10	8½ up	9 up	Fur and show
Siamese Sable.....	5-7	5-7	5-8	5-8	Fur and show
Silver (Gray, Fawn, and Brown).....	6	6	4-7	4-7	Fur and show
Tan (Black and Blue).....	4-5	4-6	4-5½	4-6	Show and fur
Vienna Blue.....	9-10	10-11	8-11	9-12	Show Fur

\* Standards recognized by the American Rabbit Breeders' Association for seniors.

† Working standard.

‡ Minimum weight for seniors, 6 pounds.



Top: The Red New Zealand is a meat, show, and hatters'-pelt rabbit.

Center: The markings of the Black Dutch rabbit are sharp and clear. This rabbit is raised principally for show purposes.

Bottom: The American Heavyweight Chinchilla is raised for fur and meat.

## PRINCIPLES OF BREEDING

**Purebreds.** A rabbit is eligible for registry as a purebred when it can meet the existing breed standard established by organized breeders. It must also show the ancestry of both parents back to the great-grandsires and great-granddams. The parents are usually purebreds, although at present they need not necessarily be registered purebreds.

Certain leaders in the rabbit industry have attempted to require registration of the parents before the offspring are eligible for registry. This would make for greater uniformity within the rabbit breeds, but the majority of producers have not supported the move. Registration of the parents should be followed by individual inspection by a competent registrar. This double check would guarantee that each rabbit not only was purebred, but that it also met the standard requirements for registry. A further step would be to secure a record of performance. This is a requirement of the dairy and the poultry industries where performance is so vital.

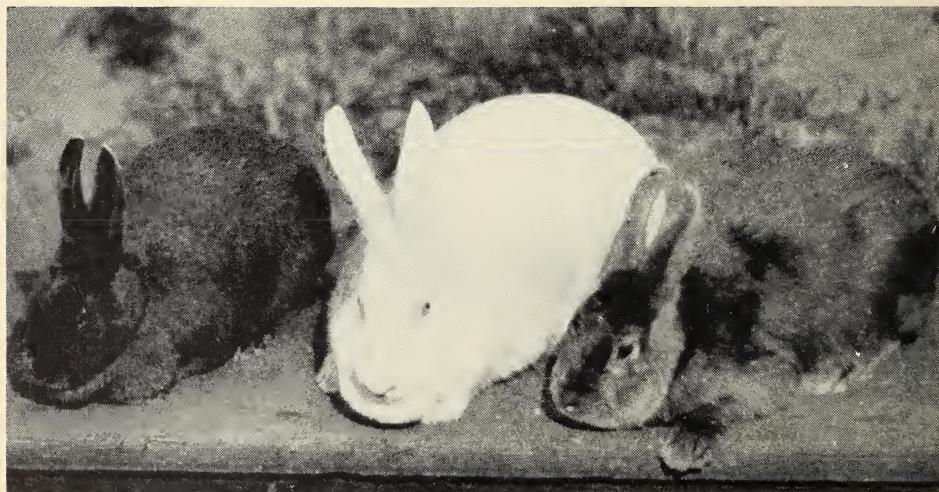
Registration of an animal does not indicate breeding qualities, but it does indicate that a purebred rabbit may be expected to show greater uniformity and

to pass these characteristics on to the offspring with more certainty than rabbits not bred to standard. Some recognized standard is essential before systematic breeding can be undertaken. Standards for new breeds will probably be established, and changes in old standards made from time to time.

Unfortunately, a strain of rabbits whose standard characters do not breed true has sometimes been set up as a breed. In the Dutch breed, for example, the pattern called for in the standard is secured in only about 50 per cent of the offspring, although 100 per cent of the desired color pattern might be secured by using parents of selected color patterns that are not standard.

The American Rabbit Breeders' Association affixes a red seal to the registration certificate if both parents are registered. If sire and dam and grandparents are registered, then a red and white seal is affixed. If all ancestors on the pedigree are registered, then a red, white, and blue seal is attached. In this merit system the registration shows how many generations have been purebred and free from disease and defects.

**Crossbreeding.** This refers to the mating of animals of different breeds.



These Blue, White, and Orange Satins (from left to right) are rabbits for the fancier.

Usually the animals in such crosses vary greatly, and the characteristics of the progeny cannot be foretold. In the mating of purebreds the characteristics can be foretold with some degree of certainty. A rabbit of unknown breeding or one that does not meet the breed standard is commonly called a "scrub."

**Line breeding.** Line breeding is breeding with animals from a single line of descent, as in one family or in families of a common ancestry a few generations back. Such breeding combines in the progeny the characters especially desired, and attempts to exclude everything outside the chosen ancestral line. Results can usually be predicted. In line breeding the matings should be both from the pedigree records and from individually selected animals in the pens. The type and condition of the individual are just as important as the pedigree.

**Inbreeding.** This is line breeding carried to the extreme, such as mating father with daughter or mother with son. Close inbreeding does not necessarily result in trouble if all foreign characters are eliminated and undesirable weaknesses are absent in both parents. However, the inexperienced breeder sometimes overlooks certain weaknesses that cause much trouble later. Most breeders feel safer in introducing outside or unrelated breeders after crossing father with daughter or mother with son. Outbreeding refers to this introduction of unrelated stock.

**Which rabbits to mate.** Rabbits should reach maturity—usually at five to eight months of age—and represent the best individuals in the desired type before they are mated. Related animals possessing the same fault should not be mated, even though they are worthy in other respects. By occasionally introducing unrelated stock, vigor and fecundity can be maintained more easily. Each breeder should have in mind the characters he wishes to fix in his animals—certain ones for meat and others for fur. It is easier to fix and correlate a limited number of

characters than many. Breeding to a single standard should be encouraged.

**Coat characters.** In the domestic rabbit, coat characters have been divided into nine general groups, some of which have been subdivided. Still other characters may appear in time. Those now recognized are:

**Agouti** The agouti color of the wild rabbit has given rise to gray, and to black and tan.

**Brown** This factor governs both brown and black, since brown is a recessive from black.

**Color** This factor determines whether the rabbit will be white or colored. Color mutations give rise to albinos with pink eyes, such as the White New Zealand from the Red New Zealand and the American White from the American Blue. There are also breeds only partly mutated toward the albino, as the Himalayan. The Californian Rabbit is a cross between the Himalayan and the White New Zealand and the Chinchilla with markings of the Himalayan.

**Dilution** The dilution factor lightens the various colors. Black becomes blue, brown becomes lilac, yellow becomes cream, and gray becomes blue gray.

**Extension** This factor involves a modification of the yellow color. There is the dominant or dark extension; the gray extension, as in the Black Siberian and Steel Gray; the Japanese extension (yellow-brindled black); and the yellow extension.

**White spotting** There are two patterns for white spotting—English and Dutch. The length and texture of the hair are also changed in the Angora coat, which is closely associated with the English factor. English spotting, the Dutch pattern, and the Angora coat are all linked in the same chromosome.

**Vienna** This factor produces a white rabbit with colored eyes, as in the Vienna.

**Rex** This mutation produces a pelt without stiff guard hairs. (See list of breeds in table 6.)

**Satin** The satin Havana was the first breed with a change in the normal texture of the fur. The fur is soft and silky and decidedly brilliant when compared with the normal pelt. Several breeds have been satinized. The mutation is a recessive and can be transmitted to all breeds. The recognized

breeds are White Satin, Chinchilla Satin, and Havana Satin. Satinrex was exhibited in 1949. There are proposed standards for lilac, orange, black, copper, and others.

In addition to coat characters there are blended colors, such as the silvers, where inheritance is apparently complex.

Breeders wanting further information on the subject of coat characters will find the work of such men as Castle (1909 and 1926) and Punnett (1912, 1915) valuable. The possibilities of new color combinations are far from exhausted, but the commercial rabbit raiser will probably profit most by selecting established breeds and keeping them up to their maximum possibilities. He should leave the development of new breeds to the specialist.

**Inheritance of fecundity.** Body weight regulates the size of litter (Gregory, 1932). Heavy does tend to have large litters, small does small litters. Averages for all breeds studied show that to produce one normal young there must be slightly over 1 pound body weight. A Flemish Giant doe weighing 12.3 pounds had a potential fecundity of 12.88 young, a Standard Chinchilla weighing 7.97 pounds, 9.17, and a Red New Zealand weighing 8.6 pounds, 11 young.

The number of young finally born, however, may be influenced by such factors as calcium and phosphorus deficiency, infectious diseases, or parasites. In the experiments by Gregory (1932), the Flemish averaged 10.2 young born and the Red New Zealand averaged 8.02. This represents a mortality of 21.1 per cent for the Flemish and 27.0 per cent for the Red New Zealand based on the potential fecundity listed above.

**Inheritance of size.** Size in rabbits is regulated by inheritance and food rather than by glands. If the glands are involved, the effect is of secondary nature, as between male and female (Goss and Gregory, 1932). Size is inherited equally from both parents. Rabbits of large breeds will give rise to large offspring when the en-

vironment is favorable. Offspring of large breeds normally grow faster than the young of small breeds.

**Inheritance of fertility.** Failure to breed (see page 25) is frequently reported, especially late in the year. Reproduction in the domestic rabbit at other seasons than spring has been brought about by planned breeding and management. Rabbits differ in the extent to which they breed out of season, but whether food and temperature or inherited constitutional vigor make them successful breeders is not definitely known. While the possibility of inherited fertility should not be ignored, the greatest attention should be given to an adequate and well-balanced ration, good housing, and opportunity for normal development.

**Resistance to disease.** Resistance to disease is believed to be related to a combination of factors, although little is definitely known about its inheritance. Certain strains of rabbits seem to be remarkably free from snuffles, for example. This fact has led some breeders to believe that resistance to disease is inherited, and that breeding stock should be selected from strains that have proved comparatively free from common ailments.

Regardless of whether or not resistance is inherited, only strains of a breed that has proved sufficiently vigorous to escape disease should be selected when available. This is one reason why the beginner should not inbreed too closely.

## PRACTICE OF BREEDING

The early part of the year is the normal breeding season for rabbits, with February and March showing the highest percentage of conception. Failure to breed is reported most often from August to October.

The doe's estrus cycle is not so regular as that of the cow, ewe, and mare. Generally the cycle is about 15 to 16 days long but during only about two or three days of the cycle is the doe barren. During the fall months this barren period

lengthens, causing many failures in breeding at that time of the year.

**When a doe is ready to breed.** If a doe is restless or nervous and rubs her chin against the hutch, she may be ready for breeding. She can then be taken to the buck's hutch, never the buck to her hutch because she is more inclined to fight when bred in her own quarters. If the doe is ready, the mating should occur almost immediately. Usually the buck falls over on one side when the mating is completed. Then the doe may be returned to her hutch.

If the doe does not readily accept service, she may be restrained by a method developed by the United States Rabbit Experiment Station. With the right hand, hold the ears and skin over the shoulders, and place the left hand under the body and between the hind legs. Force the tail upward with the index finger. In this position the weight of the doe's body is supported by the left hand and the rear quarters are raised to the normal height in mating. Where bucks are accustomed to being handled, this method will insure satisfactory mating, but it does not necessarily mean that all of the does bred will kindle (Templeton, 1938).

**Failure to breed.** Restlessness may indicate failure to conceive. There may be one or more causes. In summer, it may be high temperatures; late in the year it may be feed with too low a protein content; or it may be poor general physical condition. A long interval between litters often results in failure to breed. Since a great number of breeding failures in the fall months is normal—and to be expected—producers should avoid having a large number of junior does coming into production at that time.

If a doe is either too fat or too thin, or is in molt, she should not be bred. If she continues to have trouble in spite of the use of the best breeding methods, she should be discarded as a breeder. It is now believed that some strains of rabbits inherit the ability to breed well late in

the year. The best strains average four litters a year, with more than 110 pounds of live fryer rabbits per doe. Such rabbits are the ones from which to select breeding stock.

**False pregnancy.** If false pregnancy occurs, the doe will pull fur to build a nest well in advance of kindling—usually within 18 to 22 days after mating. She will also fail to put on flesh or to show other signs of pregnancy. When this happens, she should be test-mated or given the palpation test.

In false pregnancy the doe will probably not conceive during a period of 17 days, and remating should start on the eighteenth day after the first mating. Does that have not been affected with false pregnancy should be palpated after 10 to 14 days and remated if they are not with young.

**Testing for pregnancy.** Some producers who have been successful financially have followed a breeding schedule of mating does 40 to 42 days after kindling (Templeton, 1952). If the doe has been bred successfully, the young embryos should be sufficiently large to be felt easily from the outside by the tenth to fourteenth day after breeding. This is known as the palpation test. If the doe has not been bred successfully, she should be mated again and palpated 10 to 14 days later. Many breeders now use a colony system of breeding for those does that have missed twice and also for junior does. Especially is this practice followed during the fall months when the does are more difficult to breed. In the colony system, up to five does are placed in a large hutch with the buck for about five days.

**The buck.** A young buck should be used only once or twice a week at first. After maturity, he may be allowed to serve three does a week. One mature buck can be allowed for every 8 to 10 does. Where possible, have more than one buck available. If a buck does not sire good litters, a change can then be made. If a

buck bred to several does fails to get good litters, discard him.

**Number of annual litters.** A doe may be expected to have an average of four litters of vigorous young each year. The average in Los Angeles County in 1951 was 4.7 kindlings. In San Bernardino County the 1951 average was 4.0 litters. The doe should remain a good breeder for at least two to three years. The number of litters may be reduced because of heat, disease, or poor management. In order to average four litters a year, a doe should be bred at least once every three months or 91 days. Since the gestation period is about 31 to 33 days, and the doe nurses her young for at least four weeks, it will not be safe to breed her again until the young are at least four weeks old. The suggested practice is to rebreed 42 to 48 days after kindling. A breeding program of this kind will help insure at least four litters a year.

Each breeder should base selection of kind of breeding practice on total pounds of meat produced and cost of production. With a very heavy production of meat per doe, fryer rabbit producers may find there is a net saving with the 42-day breeding schedule.

Most producers of fryer rabbits prefer to leave the young with the doe until they are about 60 days old. This prevents the temporary loss in weight which follows weaning at four to six weeks. Since fryers are usually sold at from eight to nine weeks of age, weaning can be done at this time. The average weight of fryers is slightly over 4 pounds when sold.

**Kindling.** A few days before the doe is ready to kindle, place a nest box in one end of the hutch, opposite the central feeder, if one is used. Furnish clean straw or shavings for nesting material. Just before kindling, the doe will make the nest, normally lining it with hair or fur pulled from her belly. Be certain that the hutch is protected. She must not be frightened by dogs, cats, or other animals

just before kindling or she may scatter the young about the hutch and cause their death. After kindling she will be thirsty. Give her plenty of water. The milk flow will not start until a few hours after kindling.

The young are born naked, with their eyes closed. (The young of wild hares are born with hair and with their eyes open.) If the doe covers her young with too much fur during a hot spell, remove part of the fur to prevent smothering. In the middle of the forenoon in very hot weather take the young from the nest and place them in a hardware-cloth basket, suspended from one side of the hutch, where they can stay until the air cools somewhat in late afternoon. Return them to the nest (Templeton, 1938) in late afternoon.

**Size of litters.** A doe should not be allowed to keep more young than she has nipples. Most rabbits have eight nipples. Therefore, regardless of breed, it is best to reduce the number of young in a litter to not more than seven or eight. Rabbit raisers are averaging as high as 28 rabbits raised per doe annually (1951), in spite of fairly heavy mortality. In earlier years the average was well under 20 rabbits per doe.

**Save older does.** Rabbit breeders should be cautioned against discarding the older does simply because their litters are becoming small. Some of the older does are still fine mothers and are able to nurse large litters, so the surplus can be taken away from other does and given to one of these older does while the baby rabbits are still small. The ability of a fine old doe to breed well late in the year may be an inherited character, and it would be a mistake to replace her too soon by a younger doe that has not been adequately tested for fecundity and long life as a breeder. The record of one old doe at the United States Rabbit Experiment Station at Fontana was 22 litters raised out of 24 during her lifetime; such ability should be retained as long as possible.

## FEEDS AND FEEDING . . .

Milk is normally the balanced ration for newborn rabbits for the first three weeks. As they grow older they need a balanced ration containing suitable amounts of protein, carbohydrates and fat, mineral matter, bulk or roughage, and vitamins. It should contain sufficient moisture, be palatable, and furnish variety.

### TERMS USED IN RATION FORMULAS

The terms protein, carbohydrates and fats, mineral matter, bulk or roughage, and vitamins appear in all ration formulas. An operator needs to know what these terms mean.

**Protein.** The nitrogenous or muscle-building part of feed is called protein. About 16 per cent of the plant protein is made up of nitrogen.

**Carbohydrates and fats.** Carbohydrates (nitrogen-free extract), supplied mostly by starches and sugars, give heat and energy. Fat also gives heat and energy and is slightly more than twice as effective for this purpose as carbohydrates.

Proteins, carbohydrates, and fats are broken up into simpler compounds during the digestive process. These are either burned in the body to supply heat and energy or are used in the formation of body tissues. Unused nitrogenous and mineral products are eliminated through the kidneys, and waste carbon through the lungs.

The ash left after the nutrients are burned in the body is either acid or alkaline. That of cereals is normally acid, whereas that of most hays and vegetables is alkaline. Feed a surplus of hay and vegetables at all times to prevent acidosis, a condition which tests have disclosed can cause the death of an entire litter within 10 months. Even though grain and concentrates may be cheaper than alfalfa as a source of digestible nutrients, alfalfa balanced with a cereal should be used as an important part of the ration. Most pelleted rabbit feeds contain at least 50 per cent alfalfa.

**Mineral matter.** This is one of the essentials in rabbit feed. The mineral content of alfalfa hay is high, well above any normal requirement, with the possible exception of common salt. The common grains, such as barley, corn, oats, and wheat bran are low in calcium. If these grains are fed in large amounts, the ration will be low in calcium. If the ration consists of equal parts of a legume hay and grain, however, salt will be the only deficiency and this is fed separately by most operators. It may be fed in the proportion of  $\frac{1}{6}$  to  $\frac{1}{2}$  of 1 per cent of the total concentrates fed to both young and older rabbits.

Mineral supplements for rabbits have been credited with causing unusual growth. These claims are often unfounded. Rabbits fed mineral supplements have not always put on more weight than those fed solely on alfalfa hay and barley. But if alfalfa hay is abnormally low in ash, because of some soil condition, or if the ration as a whole is lacking in lime, inexpensive ground limestone should be added to the concentrate part of the ration.

Mineral deficiency is indicated by rickets or leg weakness. This is directly traceable to calcium and phosphorus deficiency, or to a failure to assimilate these minerals. This condition calls for a ration such as that listed on page 34, including a high protein supplement.

**Vitamins.** These factors in feed help to maintain good health. The reaction of several of the vitamins on rabbits is well known; that of others is unknown or is not well understood. Some vitamins are unstable in ordinary feed mixtures. Cer-

Table 7. VITAMIN CONTENT OF SOME RABBIT FEEDS  
(after Morrison's *Feeds and Feeding, 1950*)

Feeds	Vitamin A activity I.U./lb	Carotene mg/lb	Thiamin (B <sub>1</sub> ) mg/lb	Riboflavin (B <sub>2</sub> or G) mg/lb	Niacin (nicotinic acid) mg/lb	Pantothenic acid mg/lb	Vitamin E as mg alpha-tocopherol per lb feed
Alfalfa hay (field cured).....	19,000	11.40	1.3	6.2	17.4	8.1	11.8
Alfalfa, leaf meal.....	113,667	68.20	2.5	8.7	18.0	15.3	173.8
Alfalfa, green.....	47,167	28.30	0.7	2.1	8.2	*	69.0
Barley, green.....	34,833	20.90	*	*	*	*	*
Cabbage.....	833	0.20	0.3	0.2	1.3	*	*
Carrots.....	45,333	27.20	0.3	0.3	6.7	0.9	*
Clover, Ladino.....	42,000	25.20	*	1.8	*	*	*
Clover, white.....	*	*	*	*	*	*	45.4
Lawn clippings.....	71,833	43.10	*	*	*	*	*
Oats, green.....	45,000	27.00	*	*	*	*	*
Sudangrass, green.....	35,833	21.50	*	*	*	*	*
Barley, grain.....	317	0.19	2.6	0.6	27.2	3.0	5.0
Corn, yellow.....	3,667	2.20	1.9	0.5	9.0	2.3	11.0
Milo, grain.....	150	0.09	1.8	0.4	18.3	4.7	*
Oats, grain.....	83	0.05	2.8	0.5	6.3	6.0	16.6
Wheat, grain.....	67	0.04	2.3	0.5	28.8	6.4	15.5
Linseed oil meal.....	233	0.14	4.1	1.6	16.2	7.8	*
Peanut oil meal.....	133	0.08	3.3	1.1	77.5	24.1	*
Sesame oil meal.....	300	0.18	*	1.5	*	2.7	*
Soybean meal.....	150	0.09	1.4	1.4	17.1	6.2	*
Wheat shorts.....	133	0.08	7.6	1.1	41.6	10.8	14.4
Wheat standard middlings.....	†	†	5.8	0.8	44.3	9.3	*

\* Information lacking.  
† None, or an insignificant amount.

tain ones are stored in the body, others are not. It is therefore very important to include a good variety of feeds known to contain the essential vitamins.

**Vitamin A** is supplied by plants or plant products containing carotene. Carotene is the yellow pigment in the green part of all plants and in the yellow parts of such plants as carrots and yellow corn. Carotene is transformed into vitamin A in the liver; any surplus of vitamin A is also stored in the liver.

The process of curing green alfalfa hay destroys much of the carotene content—that of baled alfalfa hay being estimated at about 25 per cent of that of green alfalfa. The proper curing of hay preserves a maximum amount of the green color. This will insure a high carotene content, which gives an adequate supply of vitamin A to the animal.

All requirements for vitamin A may be satisfied by including high-grade leafy alfalfa hay and greens in the bulk part of the ration. Yellow carrots are an excellent source of vitamin A. Milk also contains some. A deficiency in vitamin A tends to dry the surface tissues of the respiratory and digestive tracts and leaves them susceptible to infection. A severe and prolonged deficiency leads to night blindness and, ultimately, to permanent blindness or even to death.

**Vitamin B<sub>1</sub>** may be purchased in pure crystalline form as thiamine hydrochloride and fed according to directions. However, a rabbit ration containing a variety of whole grains or the germ and bran part of such grains should supply an adequate amount of this vitamin. A deficiency of vitamin B<sub>1</sub> leads to nervous disorders. There is little excuse for a rabbit ration to be deficient in vitamin B<sub>1</sub>.

**Antibiotics and Vitamin B<sub>12</sub>** reduce mucoid enteritis. Experiments have shown that poultry, pigs, and certain other farm animals make better growth when vitamin B<sub>12</sub> and other compounds are included in the ration. Chicks were found to grow more rapidly if a basal

ration of soybean oil meal was supplemented with vitamin B<sub>12</sub> and other compounds obtained as a by-product in the manufacture of aureomycin than when the diet was supplemented with vitamin B<sub>12</sub> alone. In this case the aureomycin was credited with the increased growth. Other antibiotics were found to stimulate growth in some farm animals. The theory is that these antibiotics reduce the number of harmful organisms and the toxins they produce or that they favor the growth of organisms which produce unidentified vitamins or growth factors.

Rabbit raisers have wondered if such antibiotics and vitamin B<sub>12</sub> might help in the ration for young rabbits. The United States Rabbit Experiment Station has conducted a test of such antibiotics and vitamin B<sub>12</sub> over a period of 16 months, and has found that these supplements reduce by about 75 per cent loss from mucoid enteritis among the young during a period up to 60 days (Templeton, 1953). When it is remembered that about nine out of every 10 losses of young rabbits have been caused by mucoid enteritis, the possible saving is most promising. The tests reported to date did not indicate any change in the rate of gain or in feed consumption, but protecting young rabbits from mucoid enteritis seems to justify the use of antibiotics and vitamin B<sub>12</sub>.

In the tests mentioned above, 10 grams of aureomycin and 18 milligrams of vitamin B<sub>12</sub> were added to each ton of concentrate feed. Further tests of antibiotics and vitamin B<sub>12</sub> are continuing.

**Vitamin C (ascorbic acid)** prevents scurvy. It is of minor importance in a rabbit ration since rabbits are not subject to scurvy.

**Vitamin D (antirachitic factor)** is produced in plants and animals through the action of the ultraviolet rays of the sun. When these light rays strike the skin of an animal, they change certain substances to vitamin D. This is why the vitamin is often referred to as the "sunshine vitamin."

A vitamin-D deficiency in young animals leads to rickets—characterized by lameness, swollen joints, and bone deformities—and to leg weakness. Regardless of the amount of calcium and phosphorus in the diet, animals cannot make use of them unless vitamin D in some form is provided. Nearly all prepared feeds have liberal amounts of vitamin D added.

**Vitamin E (antisterility vitamin)** usually measured as alphatocopherol, is present in whole grains, milk, fresh greens, and alfalfa hay or alfalfa meal. The popular rabbit rations usually include a sufficient amount of this vitamin.

**Vitamin-G complex** includes both riboflavin (lactoflavin) and pantothenic acid, the antidermatitis or filtrate factor. Vitamin-G complex is seldom used but the components riboflavin and pantothenic acid are used. The vitamins making up this complex are soluble in water and are not destroyed by heat. Riboflavin is important to the utilization of food and to growth. It is present in green feed, both fresh or dried, and in milk. Pantothenic acid is essential for good growth and has been suggested for the breeding diet. Molasses is a good source, as are alfalfa, grains, and oil meals. Any marked deficiency in vitamin-G complex indicates a need to revise the whole ration.

**Niacin (nicotinic acid)** is widely distributed in feeds. A deficiency may lead to paralysis, skin disease, and other troubles, but there is little likelihood of a niacin deficiency in rabbit rations.

**Vitamin K** is usually referred to as the antihemorrhagic vitamin necessary for normal blood clotting. It is abundant in alfalfa hay and green feed and is also found in bran and soybean meal.

Tests have been conducted on various feeds to discover their vitamin content (Daniel *et al.*, 1937; Booker *et al.*, 1939). These tests are by no means complete, but some of the facts discovered about the vitamin content of popular rabbit feeds appear in table 7.

**Bulk** prevents indigestion and impaction. Rabbits are able to use feed with a large amount of crude fiber; yet, if there is too much indigestible fiber, the feed will have insufficient total nutrients to insure good growth and health.

Alfalfa hay cut before bloom is relatively low in fiber; it ranges from only 18 to 20 per cent. Coarser types of alfalfa hay in the advanced blossom stage may run as high as 30 per cent fiber. Coarse hay is totally unsuited to rabbits.

The fiber content of grain must be considered in total weight per bushel. The fiber average for barley grain is about 4.6 per cent. Barley grain is worth about 5 per cent less for each per cent of fiber above the average. A good variety of barley should weigh 42 pounds or more to the bushel, but some barley meeting this weight may still be rather high in fiber. Grains rolled or ground into meal may contain large amounts of concealed fiber.

Carbohydrate content and real value of the grain are fairly closely related. In practice, however, it is hardly possible to do more than to know that the grain is plump and as heavy as possible per bushel. If pelleted feed is used, the responsibility for regulating the crude fiber then rests with the feed miller.

Oats run much higher in fiber than barley and are usually more expensive. They are used very little in California, so are not considered in this circular.

## WHOLE VERSUS GROUND FEED

Rolled barley has been fed to rabbits for years. The extra cost of rolling, however, makes it an expensive feed. Experiments at the College of Agriculture at Davis disclosed that rabbits past the nursing age made as good gains on whole barley as on either the rolled or ground form.

Tests at the United States Rabbit Experiment Station indicated that grinding, rolling, or pelleting cereal grains did not increase their feeding value. It would therefore seem best to use the whole

grains whenever practical to reduce feeding expenses. Poor quality is readily detected in whole grain or unground alfalfa.

### PELLET FEEDS

The use of pellet feeds for rabbits has increased rapidly since 1930. By 1947 it was used by all coöperators in the Southern California Rabbit Management Study. Although complaints about faulty nutrition often seem due to insufficient protein in pellet feeds, many rabbit raisers have used this type of feed exclusively, with excellent results. If it contains the proper nutrients it should serve very well. (A carrier for pelleted feed is shown on page 16.)

Many pellet feeds especially prepared for rabbits are on the market. These are no better and no worse than what goes into them. In earlier years the feeds contained only five or six different ingredients; now they contain at least 25 to 30. Nearly all feeds now used contain about 15 per cent crude protein, which should give good results.

Costs of feeds and their availability will usually determine what is best to include in pellet feed. Mill by-products are often used in such pellet feed by manufacturers, and if the feed contains adequately high protein supplements, it should give good results.

The composition of almost any common rabbit feed is given in reference books on feeds. The digestibility tables are usually based on tests with cattle and sheep, but they can also be taken as a partial guide in checking on the total digestible nutrients present for rabbits. If you know this total, compare similar feeds for cost at current quotations.

### FEED FOR VARIETY AND PALATABILITY

**Rabbit preference.** Rabbits definitely prefer certain kinds of feeds. This was demonstrated by feeding trials with self-feeders at the United States Rabbit Experiment Station (Templeton *et al.*,

1942). In order of preference the grains may be listed as oats, wheat, milo, barley, and corn. When pellets consisted of plant proteins, the order of preference was peanut meal, soybean meal, sesame meal, linseed meal, cottonseed meal, and hempseed meal. High-grade alfalfa hay was relished. And green feed, such as alfalfa, or succulent feed, such as yellow carrots, was readily accepted by nearly all kinds of rabbits.

A ration containing alfalfa hay, barley, and a few yellow carrots or greens would probably be better relished by rabbits than a ration of alfalfa hay alone. There would also be less likelihood of food deficiencies. Alfalfa hay seems to be relished by rabbits that are fed largely on pellet feed.

Mill products in the form of mash or pellet feed give considerable variety. These products contain wheat, bran, shorts, middlings, mill run, ground barley, ground corn, ground milo, linseed meal, soybean meal, peanut meal, cocoanut meal, oat chop, and salt.

**Change feed gradually.** Rabbits should become accustomed gradually to change in feed. A drastic change, even for improvement, may cause a temporary digestive disturbance. When they refuse to eat new kinds of feed, mix a little of the new with some of the old feed that is relished.

**Wild plants.** Certain wild plants **can** be fed to rabbits if they are cut while green and succulent and are wilted overnight before being used. Other wild plants are undesirable or harmful to rabbits and **cannot** be fed.

Plants that **can** be fed to rabbits:

Bermuda grass (*Cynodon*)

Bur clover (*Medicago denticulata*)

Chicory (*Cichorium intybus*)

Clovers (*Trifolium pratense*, red clover; *T. repens*, white clover; *T. hybridum*, alsike clover) and *Melilotus alba* (white sweet clover)

Dandelion (*Taraxacum officinale*)

Filaree, alfilaria, or stork's bill (*Erodium*)

Foxtail or wild barley before heading (*Hordeum murinum*)

Johnsongrass, first cutting (*Holcus halepensis*)

Lettuce, wild or prickly (*Lactuca scariola*)

Malva or mallow, cheeseweed (*Malva parviflora*)

Morning-glory, wild (*Convolvulus arvensis*)

Mustard, wild black (*Brassica nigra*)

Oats, wild—when green (*Avena fatua*)

Plantains, common (*Plantago major*) and English, or ribwort (*P. lanceolata*)

Thistle, Napa (*Centaurea melitensis*), and yellow star (*C. solstitialis*)

Plants that **cannot** be fed to rabbits:

Burdock (*Arctium minus*)

Chickweed (*Stellaria media*)

Clover (*Melilotus indica*, sour clover)

Fireweed (*Epilobium angustifolium*)

Goldenrod (*Solidago californica*)

Horehound (*Marrubium vulgare*)

Lambsquarter and similar species (*Chenopodium*)

Lupine (*Lupinus*)

Milkweed (*Asclepias speciosa*)

Miner's lettuce (*Montia perfoliata*)

Poppies (*Eschscholtzia, Papaver*, etc.)

Tarweed (*Madia*)

Turkey mullein (*Eremocarpus setigerus*)

**Cultivated plants.** Several cultivated forage plants may be fed: green alfalfa, green barley, and beet or chard leaves. Feed less of kale and cabbage leaves. Kale and other members of the mustard family give a very strong odor to the urine; they are also more likely to cause bloat than other greens.

**Substitutes for greens.** Alfalfa leaf meal and yellow carrots have proved fairly good occasional substitutes for greens in poultry feeding. Either of these

feeds is suitable for rabbits, but alfalfa meal should be fed only with other feeds in a dampened mash or in pellet form. A rabbit cannot eat finely ground feed. Alfalfa leaf meal should average over 20 per cent protein, which is well above the percentage in alfalfa meal. The fact that alfalfa leaf meal is used as a valuable substitute for greens, however, has prompted some manufacturers to produce meal with a very low protein content. Naturally this type of meal will not give satisfactory results. A good grade of alfalfa hay will usually be the most economical for bulk, and yellow carrots or various grasses for the necessary succulence.

**Amount to feed.** If the ration includes a good grade of alfalfa hay, grain, and protein supplement, one or two feedings daily will be sufficient. Pellets may be fed in hoppers and the rabbits given free access to the hoppers. The evening meal may be the larger one as rabbits eat more at night than in the daytime.

A common feeding practice is to feed single, full-grown rabbits from 4 to 6 ounces of pellet feed daily. After a doe has been palpated at 10 to 14 days after mating, her feed may gradually be increased until the doe and litter are receiving about 48 ounces when the young are seven to eight weeks old. The yearly feed consumption for a doe and her litters will be up to 560 pounds, or at the rate of about 4.5 to 4.7 pounds of feed for each pound of meat produced.

In the 1951 San Bernardino County Rabbit Cost Study, the annual consumption of pellet feed per doe and her litters was around 400 pounds when fed along with hay and grain. In one rabbitry, where 4.5 pounds of feed were required to produce a pound of meat, each doe received 413.2 pounds of feed pellets, 30.1 pounds of hay, and 9.3 pounds of grain. Another rabbitry that used 4.6 pounds of feed to produce a pound of meat fed 466.8 pounds of pellets and 0.9 pound of grain per doe for the year. Such variations in the amount of feed used can be expected

in accordance with the kinds of feed and the methods of feeding, but producers should try to keep feed consumption down to 4.7 pounds or less for each pound of meat produced.

Hand-fed rabbits should be made to clean up their feed before receiving more. Refusal may mean that the quality of the feed is poor. While most commercial rabbit raisers feed only pellets, some home producers feed hay, chopping it to prevent waste. A saw can be used to cut alfalfa hay into 3-inch lengths. Roaster rabbits have consumed 5.5 pounds of mixed feed per pound of rabbit produced. The daily ration for the older does and bucks will include about  $2\frac{1}{2}$  ounces of concentrates and all the alfalfa hay they will eat. Allow about 1/10 pound green feed or root crop for a mature rabbit of medium weight.

For does and litters over two months of age, feed daily a limited amount of the concentrate mixture, along with alfalfa hay and 1/10 pound of green feed or root crop. Full feeding of the concentrated portion of the ration to junior stock causes them to put on too much flesh for optimum results in breeding. It may be best not to feed greens to rabbits under two months of age, which is the normal age for marketing fryers.

It is not essential to change the ration greatly between winter and summer. According to G. S. Templeton, a doe and her litter of seven will consume, from time of mating to weaning in summer, an average of 79.30 pounds of feed. The consumption in winter averages 88.81 pounds. While the doe and litter consume more feed during winter, the fryers also weigh more at that season. The feed required to produce a pound of fryer was practically the same for winter and summer—3.46 pounds in winter and 3.45 pounds in summer.

**Feeding the nursing doe.** From breeding to kindling, the daily consumption of a mature doe of the White New Zealand breed is approximately 0.16

pound concentrates, 0.24 pound alfalfa hay, 0.10 pound green feed, or a daily total of 8 ounces of hay and grain. Feed the doe liberally during pregnancy and be certain to include a good supply of protein in the ration.

Food for a nursing doe needs special consideration. During the first week after kindling, a 10-pound doe will do well on a normal daily ration of approximately 5 ounces of hay and 4 ounces of grain or an equal amount of pellet feed. After the first week give her as much grain as she will clean up. Whole grains and germ meal are rich in thiamin ( $B_1$ ), which she needs. (See table 7.) Also give her greens for additional  $B_1$ .

**Feeding the doe and litter.** A doe with young over two weeks old will consume two to three times the normal amount of feed. As the young grow and begin to eat, the doe and litter will need as much as 18 ounces of grain daily. They will also need a greater amount of hay. By the seventh or eighth week they may be consuming as much as 48 ounces of feed.

Over a 60-day period, with hand feeding, a White New Zealand doe and litter of six would average close to 19 ounces of hay and 13 ounces of concentrates daily. With a self-feeder the average would be nearer 16 ounces of concentrates and a little over eight ounces of hay for the same period.

The amount consumed for each pound gained in live weight was taken for a 56-day period, with both hand feeding and a self-feeder. With hand feeding, where hay made up 60 per cent and concentrates 40 per cent of the ration, a doe and litter consumed 2.12 pounds of concentrates and 3.18 pounds of hay for each pound gain live weight (average nutritive ration 1:3.7). With a self-feeder a doe and litter consumed 2.50 pounds of concentrates and 1.04 pounds of hay for each pound gain in live weight.

In a self-feeder test without protein supplement a doe and litter of the White

New Zealand breed consumed 2.62 pounds of concentrates and 1.40 pounds of hay and greens for each pound live weight. When the plant-protein supplement was included, the doe and litter consumed 2.50 pounds concentrates and 1.04 pounds hay and greens for each pound live weight.

At first the young will eat as much pellet plant-protein supplement as all grains combined, but the general average is  $\frac{2}{3}$  grain and  $\frac{1}{3}$  protein supplement.

The adequate ration (Templeton *et al.*, 1942) for a doe and her litter will include the following:

#### **1. Roughage:**

*a.* Chopped alfalfa hay—whatever amount the rabbits will clean up. (May substitute clover or other legume hay.)

*b.* Green feed—about  $\frac{1}{10}$  pound daily per doe, and fed only in racks above the floor where it cannot be contaminated. Alfalfa, grass, carrots, or other wholesome greens will serve. (May supply 60 per cent of ration when hand-fed, or up to 30 per cent when concentrates are fed in a self-feeder.)

#### **2. Concentrates** (allow about 40 per cent if hand-fed or up to 70 per cent when fed in self-feeders):

*a.* Cereal grains, 4 parts, by weight, to include two or more of the following: whole barley, whole wheat, and whole milo. (Suggest feeding wheat when old crop milo is not palatable. At other times select whichever grain is relatively the most economical.) For herd bucks, dry does, developing does, and bucks, the concentrates may include 2 parts whole grain and 1 part protein supplement. Allow about  $2\frac{1}{2}$  ounces of concentrate mixture daily for animals of medium weight.

*b.* Protein supplement—2 parts by weight, selected from the following: soybean meal, linseed meal, peanut meal, or sesame meal. (Suggest either pellet or pea-sized oil-cake form; pellets may be  $\frac{3}{16}$  inch in diameter and  $\frac{1}{8}$  inch in length. If necessary to feed in meal form, half the grains should be rolled to prevent the meal from settling out, and the mixture should be dampened just before feeding.)

**3. Salt**—added as sifted salt to the ground part of the ration or as salt spools, allowing 0.16 per cent of the concentrates by weight.

**4. Water**—available at all times.

#### **Feeding for prime pelts and furs.**

The well-balanced ration which keeps the rabbit healthy and in growing condition also favors prime pelts and furs with good luster. There is little reason to change the type of ration during the two or three weeks before pelting. Density and length of fur are largely a matter of breeding.

#### **General rabbit-ration specifications.**

Most rabbit raisers producing fryers want a young rabbit that will weigh about 4 pounds live weight at 56 to 60 days. In order to get such weights for White New Zealands and Californians, it is necessary to feed a ration of certain specifications. Up until after 1930 it was common practice of rabbit raisers in California to feed about 60 per cent alfalfa hay in the ration and 40 per cent concentrates. With such a large percentage of alfalfa hay, the rabbit was unable to consume enough feed to get adequate protein for the best gains in weight, even when the rations contained 13 to 14 per cent protein. Feeding experiments conducted by the United States Rabbit Experiment Station at Fontana showed that by reducing the alfalfa hay to about 40 per cent and increasing the concentrates to 60 per cent, it was possible for the fryer rabbits to get enough protein to reach a weight of 4 pounds in 56 to 60 days instead of only  $3\frac{1}{4}$  to  $3\frac{1}{3}$  pounds at the same age under the older methods of feeding.

The exact proportions of roughage and concentrates should vary with the kind of rabbits being fed. Pregnant does and does with litters should have more protein than dry does, herd bucks, or developing young past the weaning age. The facts secured were based on tests with 3,222 litters. A very definite correlation between the amount of protein and the rapidity of gains was found to exist.

Based on the experiments reported by George S. Templeton (1952), specifica-

tions may be given for the two general types of rations.

For pregnant does and does with litters, the ration should include:

	<i>Per cent</i>
Protein .....	16 to 20
Fat .....	3 to 5.5
Fiber .....	14 to 20
Nitrogen-free extract (carbohydrates) .....	44 to 50
Ash or mineral .....	4.5 to 6.5

For dry does, herd bucks, and weaned young, the percentage of nitrogen is lowered, as shown below:

	<i>Per cent</i>
Protein .....	12 to 15
Fat .....	2 to 3.5
Fiber .....	20 to 27
Nitrogen-free extract .....	43 to 47
Ash or mineral .....	5 to 6.5

In order to have feeds that meet these specifications, milling companies preparing pellet feed will need to exercise good judgment in the selection of materials. When protein supplements are restricted, as happened during World War II, it may be necessary to reduce the amount below that shown by experiments to be most desirable for rapid gains. Scarcity and high cost may justify such reduction below the percentages considered ideal, but gains in weight will probably be reduced accordingly. Instead of getting 4 pounds live weight in 56 days, it may take one to three weeks longer for the fryer rabbit to reach that weight. Where the producer has home-grown feeds or can purchase feeds at a very reasonable price, if protein is expensive he may conclude that it will pay to wait a little longer for the desired weight.

It should be remembered, however, that mucoid enteritis takes a heavy toll of young rabbits in California, accounting for about 50 per cent of young mortality during the nursing period. Dr. Everett E. Lund, parasitologist of the United States Experiment Station at Fontana,

has reported that nine out of every 10 rabbits lost during the fifth to eighth week of life have enteritis. Where there is heavy loss from enteritis within 10 to 14 days of marketing, it may be to the producer's advantage to market his fryers as early as possible after the essential development and finish are secured. By all means he should use a feed containing antibiotics during this critical time, particularly if mucoid enteritis (bloat or scours) is present. These are matters requiring good judgment. (Also see the use of antibiotics and their effect in reducing mucoid enteritis in young rabbits, p. 29.)

A further discussion of feeding and management of rabbits for commercial fryer production is given by Templeton (1952).

**Buying of feed.** Buy for the digestible nutrients present in feed, and measure the economy of a ration by total feed cost in the rabbitry for pounds of meat or other products sold rather than by feed cost per doe and litter. There is a wide range in the prices of suitable feed. Some operators fail to show good profit because they buy in insufficient quantities or during high prices. For instance, alfalfa hay in ton lots usually costs less than by the bale, and barley less by the ton or half ton than by the sack. As a rule, the price of barley is lower soon after harvest than at any other period of the year. This is not true of alfalfa.

Poor grades of hay, grain, or pellet feed are not economical at any price. On the other hand, the best grades of alfalfa hay, sometimes called "rabbit alfalfa," are expensive. A moderately good grade of hay with high protein and low fiber content is all that a rabbit raiser can reasonably expect.

Some operators attempt to grow part of the feed, but this is not advisable if the land is high priced or the cost of production high. It may pay to grow enough green feed for the minimum daily requirement of about 1/10 pound for each breeding doe.

Small operators who do not have adequate storage space available cannot buy the separate ingredients in large enough quantities to save cost. In some sections of the state, a movement has been started to buy alfalfa hay and perhaps other supplies co-operatively. Such a plan is feasible if the organization is well managed, but members tend to withdraw whenever prices are not entirely satisfac-

tory. Of course, it is recognized that some operators may be in a position to buy advantageously outside of an organization.

A rabbit raiser must be able to work easily with other people if he plans to buy co-operatively.

The problems of feed costs are discussed under "Business Aspects of the Industry," on page 55.

## MISCELLANEOUS CARE OF RABBITS . . .

This includes learning how to carry and handle the rabbit; how to mark it; and how to protect its quarters against extremes in temperature.

**Carrying the rabbit.** One of the first lessons in rabbit keeping is how to carry a rabbit. Never pick it up by the ears or the feet. Always take hold of the loose skin over the shoulders with one hand and place the other hand under the rump to support the weight from beneath. Turn its feet away from you so that it will be less likely to scratch if it struggles. Should it struggle, simply rest it on the ground or on a table until it is quiet.



Lift a rabbit by holding the loose skin over the shoulders with one hand and supporting the rump with the other hand.

**Handling.** Young rabbits should be handled as little as possible. If they are placed in a wire basket during the hot part of the day, handle them gently. Older rabbits being fitted for show should be handled often enough to make them gentle on the judging table.

**Marking.** Valuable rabbits are usually marked with a tattoo needle on the inside of the left ear. The right ear is for registration only. The tattoo needle may



Carry a rabbit under the arm firmly so that it can neither scratch nor bite. The rump should be supported in this position also.

be the small pen-sized type. Large-scale rabbit raisers may prefer one of the electric tattoo sets suitable for marking a large number of rabbits at a time. Marks may consist of a number and letter or letters, such as DE-25, or the year, month, and day, as 49-5-10. These numbers or letters are then entered on the registry and pedigree blank. The method of tattooing saves the operator's time in looking up dates.

For temporary marks during exhibition simply wipe off the waxy surface of the ear with a vinegar-moistened pad (do not have the pad too wet) and mark with a moistened indelible pencil.

#### **Protecting against hot weather.**

Protection against high temperatures is discussed under the construction of lath shelters (see p. 14). In addition to the shade of a lath shelter or trees, sprinkle water on the floor or ground around the hutch to cool the atmosphere, but do not let any of the water splash on the hutch floor. See that the hutch itself is well ventilated. In a hot climate remove the upper part of the hutch back, if it is boarded solid, and cover the opening with wire. This can be replaced very easily when it is needed during the cold and damp of winter weather.

Provide plenty of fresh water during high temperatures, but reduce the grain to a minimum and cut down the ration as a whole to prevent the rabbits from becoming too fat.

A sprinkler may be placed on the roof of the rabbit shelter and turned on during hot spells to cool the air. Be sure to prevent roof leaks, which might wet the rabbits.

The method of keeping baby rabbits in a wire basket during the hottest part of the day has practically eliminated baby-rabbit mortality from heat at the United States Rabbit Experiment Station at Fontana (Templeton, 1938).

**Protecting against cold and wet weather.** Board in the back wall of a

hutch in a cool climate, as discussed on page 12. Wire floors should also be protected. This is possible by an overhang of the roof in front or by keeping the hutch beneath a shed roof. In addition, canvas or burlap should be hung from the edge of the overhanging roof at the front of the hutch unless the hutch is protected by a shed roof.

#### **Castration not recommended.**

Growth between males and females does not differ materially until after market age; consequently, castration has no advantage for young meat stock. If fur rabbits are to be kept for six months or longer, there may be a slight advantage in castration, provided the market wants large rabbits.



Identification letters and numbers are tattooed on the inside of the left ear. The right ear is for registration only.

## DISEASES AND REMEDIES . . .

Every operator should know enough about rabbit diseases and their treatment to recognize symptoms. Treat the animal if the disease is minor and consult a competent veterinarian if it is serious. Studies reported for 1948 show an average annual mortality of 38.8 per cent for does, 22 per cent for young rabbits, and 17 per cent for bucks.

### RABBIT MEDICINES

Heavy mortality is perhaps the most important factor in regulating production per doe. The very decided increase in the pounds raised per doe noticed in recent years indicates that diseases are now more successfully controlled. Breeding failures usually contribute more toward limiting production than does mortality in young or unweaned animals. If mortality for all ages is considered, however, then mortality is perhaps the most important factor in regulating production.

Coccidiosis, snuffles, bloat disease, and failure to breed usually cause the greatest loss. Diarrhea, pot-belly, slobbers, and similar ailments should usually be considered symptoms rather than specific diseases. Any great loss of baby rabbits will probably be caused by wrong feeding, wrong breeding, poor housing, or unfavorable climatic conditions, such as excessive heat.

If you are a beginner, ask someone who recognizes healthy animals to help you select your breeding stock. Then by proper care and management you will be able to keep the rabbits practically free from disease. New stock introduced into the rabbitry is one of the greatest sources of disease. Buy only healthy, vigorous animals and keep them apart until a clean bill of health is established. This will prevent the spread of such troubles as coccidiosis, worms, ear canker, and favus. These diseases and parasites need not cause serious loss if isolation and sanitation are practiced; but careless handling can make the rabbit business decidedly unprofitable.

**Giving medicine.** Individual medication should be avoided as far as possible,

except in the treatment of localized, external infections or infestations, such as body or ear mange, favus, et cetera. Applying more than two or three drops of liquid into the nasal passages of a rabbit is hazardous because the animal is likely to inhale the liquid if it is frightened, and this, in turn, could cause pneumonia. Great caution is therefore needed when giving any kind of medicine. Powder is safest to give internally. Sometimes a capsule can be given safely by placing it well back on the tongue.

### INFECTIOUS DISEASES

#### Coccidiosis

Different microscopical animal parasites have been associated with coccidiosis, including *Eimeria irresidua*, *E. perforans*, *E. magna*, and *E. media*, which affect the intestinal tract, and *E. stiedae*, the liver form. Others that are less well known may not be native to our domestic rabbit and are seldom encountered.

So far as is now known, there is no danger of any animal, other than the rabbit, spreading rabbit coccidiosis. *Eimeria* parasites are apparently limited to herbivorous animals, and the species attacking rabbits do not normally attack other animals. Operators should keep in touch with the latest recommendations of the United States Rabbit Experiment Station at Fontana, or of others, on the progress being made in study of this disease.

**Intestinal coccidiosis** is now associated with the parasite *Eimeria perforans* Leuc. This form may cause death of young rabbits in six to 15 days, especially of rabbits six weeks to two months old.

Four intestinal species of coccidiosis organisms are known, and other forms

as yet undescribed are being studied. In California there is a reasonably high tolerance, although not equally high, to all four. A rabbit raiser must understand the nature of this disease to distinguish it from mucoid enteritis or any similar condition with which coccidiosis is confused. Probably mucoid enteritis rather than coccidiosis is the cause of much rabbit mortality in California.

**Symptoms.** Intestinal coccidiosis may show no outward symptom in its early stages. In its advanced stage the rabbit has poor appetite, dull fur, lacks energy, loses weight, may drool, and may have abdominal dropsy. Diarrhea may be present. Many young rabbits die in convulsions. Post-mortem examination may show small bloodshot areas about the size of a pin point or pin head on the inner

coat of the intestines. The blood and flesh may be pale and watery.

**Treatment.** No treatment has been found effective in control.

**Preventive measures.** The egg capsules of coccidiosis incubate in manure. Three or four days are usually necessary for the egg to develop into infective form. If the manure is removed before the parasite reaches an infective stage, and the operator keeps feed or water from being contaminated, healthy young rabbits stand a good chance of escaping infection. Older rabbits are even less susceptible under sanitary conditions.

Any feed coming in contact with infective manure should be destroyed, and any hutch or carrier exposed should not be used again until it is thoroughly disinfected. This is one of the important

Every rabbitry should have a padded bench for use in examining and treating animals.



reasons why all hutches should be self-cleaning and should be kept dry and sanitary at all times.

**Liver coccidiosis** is caused by the parasite *Eimeria stiedae* Lind. The raised white areas found on the liver are responsible for the common name of the disease "spotted liver." This form is often chronic with a doe which, although not visibly sick, is capable of spreading the disease to her young.

**Symptoms.** There may be no outward indication of spotted liver in some young rabbits attacked by the disease. Not until the animal is dressed for eating will the white spots be detected. Presence of these spots indicates a mild, chronic case. Rabbits carrying the disease in chronic form may not make the best gains. In severe cases young rabbits may die.

**Treatment.** No treatment other than sanitation has been effective, although experiments are continuing.

**Preventive measures.** The preventive measures used for intestinal coccidiosis are also used for the liver form.

**Eye trouble (blindness of young).** Eye trouble is usually due to infection and is treated accordingly. The adults may have runny eyes; the young, swollen eyelids with red pimples sometimes at the edges. Young animals may become totally blind. Eye trouble usually occurs in filthy hutches where the air is contaminated by injurious gases from manure.

**Treatment.** Wash the eyes of affected animals with boric acid—1 tablespoon of powdered boric acid to 1 pint of water. Boric acid dissolves best in hot water, but the solution should be cooled before it is used. Iodoform ointment may be used for discharging sores that may develop.

Eyedrops prescribed for infections with human beings, such as 25 per cent argyrol, are considered safe for rabbits.

**Xerophthalmia** is another form of eye trouble. It is caused by vitamin-A deficiency (see "Vitamins," p. 27).

**Favus (ringworm).** A vegetable parasite causes favus. Rabbits up to three

months of age are especially susceptible. Older rabbits, which are carriers of the disease, are quite resistant, although some of them will have a few small skin lesions. This disease is most commonly brought into a rabbitry by new rabbits. It can also be transmitted from caretaker to animals or from animals to caretaker.

**Symptoms.** The parts most often infected are the nose, the area around the ears, the legs, and the paws. There may be from one to 30 lesions; these vary in size from that of a pin head to a dime. They are very typical, occurring as depressed cups covered with a yellow crust which, in old lesions, becomes grayish. If the crust is removed, the cuplike depression appears to be covered with a grayish powder. The hair on the lesions breaks off, grayed and split, and the lesions, which give off a mousy odor, are left bare.

**Treatment.** According to Dr. E. E. Lund of the United States Rabbit Experiment Station at Fontana, if only a few animals are involved the simplest treatment is to: 1) clip or shear the affected areas and one-half inch outside; 2) bathe in warm soapy water and dry; and 3) apply one of the proprietary substances available at all drug stores and recommended specifically for the treatment of athlete's foot. These usually contain salicylic acid and a number of other ingredients which the individual would have difficulty in obtaining. Follow directions on the container. Tincture of iodine or straight salicylic acid solution will help but are considered somewhat harsh.

Where a great many animals are affected and large quantities of material are needed, Dr. Lund suggests having the following preparation made up at a drug-store: 1 part of a 10 per cent solution of iodine crystals in 95 per cent ethyl alcohol; 3 parts of a 4 per cent solution of potassium iodide in distilled water. Mix the two and when the iodine is thoroughly dissolved, add enough glacial acetic acid to make up about 7 per cent

of the total. Be sure to disinfect all equipment. Paint the affected parts with this preparation.

**Preventive measures.** Methods of control depend on the extent of the infection. After killing the animals and disposing of them, use a torch and burn all loose hair about the hutches in which they were housed. Thoroughly scrub and disinfect the entire hutch, all feed and water containers, and toilets. Closely check the remaining rabbits to detect any new outbreak of the disease. There will be a need for extreme patience and rigid cleanliness to keep spores from being carried by air, water, utensils, clothing, the operator himself, or by flies, mice, et cetera.

**Infectious myxomatosis (mosquito disease).** In parts of southern California in 1930 there were several cases of an infectious virus disease now commonly known as mosquito disease. This disease has appeared in various parts of the state with high mortality. In the 1930 outbreak all rabbits attacked died. Attempts to immunize were unsuccessful. Since then some rabbits have been known to recover without previous vaccination. Others have shown partial resistance. Reports (Fisk and Kessel, 1931; Vail, 1943; Kessel *et al.*, 1931) indicate that recovery from either the California type of myxomatosis or the South American type will render immunity to subsequent inoculations with both strains of the virus.

**Symptoms.** The first symptoms are a swelling in the regions of the nose, lips, and genitals. The ears thicken and usually droop. The membrane of the eyelids is also inflamed. The pus developing in nose and eyes discharges and spreads the disease. If a rabbit lives longer than a week or 10 days after showing the first symptoms, nodules will develop around its eyes, nose, or on the ears. An autopsy usually discloses an enlargement of the lymph nodes and the spleen.

**Preventive measures.** No cure for myxomatosis has yet been developed, al-

though a number of antibiotics have been tried without success. The most effective control still consists of slaughtering the infected rabbits, burning or deeply burying them, and continuing work on mosquito abatement to eliminate all infective mosquitoes carrying this virus disease.

**Pasteurellosis.** The various forms of pasteurellosis include snuffles (nasal catarrh), abscesses or boils, acute septicemia (similar to hemorrhagic septicemia of farm animals), and another form which attacks the genital tract. Pasteurellosis was once known principally as "snuffles," but the other forms are caused by the same organism—*Pasteurella multocida* (*P. cuniculicida*). Two types of the *Pasteurella* organism are now listed—*P. multocida* and *P. hemolytica*—but the strains of *P. multocida* only are pathogenic to rabbits.

**Snuffles or nasal pasteurellosis** produces symptoms similar to the symptoms of a bad cold. Conditions favoring a cold may also favor pasteurellosis, but where a cold is usually a temporary condition, snuffles pasteurellosis usually grows progressively worse. The ordinary cold form of the disease may not be fatal, but the more advanced stages will leave the animal of little or no value as a breeder. The presence of "sneezers" in a rabbitry is always noticeable to prospective buyers. Some animals affected with a mild nasal form apparently recover, yet remain carriers of the disease.

**Symptoms.** In the nasal form the rabbit usually sneezes. At first the nostrils are a little more moist than usual; then a thin, watery discharge begins. Next, snuffling or coughing develops and the discharge from the nostrils becomes thicker. The rabbit may wipe its nose on its forepaws, soiling and matting the fur. The passageway from eyes to nostrils may become clogged and cause water to run down the cheeks from the corners of the eyes. Drooling is also a symptom.

**Treatment.** There is no known cure for any form of pasteurellosis. A mixed

infection bacterin (Lepin) has been used to treat the snuffles form, but it did not offer satisfactory protection, and its use is not recommended by some veterinarians. The person who attempts any kind of treatment should protect his clothing and disinfect his hands afterward.

If the eyes are affected, treat as prescribed for mild forms of eye trouble in the section on "Eye trouble," page 40.

**Abscesses or boils** sometimes develop from pasteurellosis. These may occur on any part of the body. Lanced abscesses will discharge thick yellow pus; encapsulated abscesses may be found within the body cavity in autopsy. If treatment is attempted, lance and drain the abscess as discussed under "Boils and Abscesses," on page 44. Protect the clothing and thoroughly disinfect the hands afterward. Except for very valuable animals it is best to cull infected ones.

**Acute septicemia** occurs occasionally. This form of pasteurellosis closely resembles hemorrhagic septicemia of farm animals. It is usually fatal, causing death in 24 to 48 hours. Autopsy shows the lungs to be congested, with inflammation often extending into the trachea. A greatly enlarged spleen and small hemorrhagic areas under the skin are also symptoms.

**Genital pasteurellosis** is a form of the disease which attacks the genital tract of adult breeding rabbits. The danger is in spread of the organisms in mating. This form may become acute or it may linger in a chronic state (see also "Vent Disease," p. 43).

No treatment for either the septicemic or the genital-organ form of pasteurellosis should be attempted.

**Preventive measures.** In all forms of pasteurellosis segregate suspected carriers. If only a few rabbits are affected, it is better to destroy them than to attempt treatment. If many are affected, segregate the suspected carriers, and quarantine the sick until they can be disposed of. Burn or deeply bury the carcasses.

Scrub and disinfect the entire inside of each hutch. Clean and disinfect all food and water containers and toilets. Destroy the contents of each nest, then clean and disinfect the nest box.

The most important preventive measure in all forms of pasteurellosis is for rabbit raisers to select breeders very carefully, then maintain the strictest possible sanitation in the rabbitry. Never interchange feed or water containers in the hutches and never allow damp or chilly conditions to exist at any time.

**Pseudotuberculosis.** Nodules or tubercles sometimes seen in lungs, liver, the intestinal tube, and spleen, similar to those in tuberculosis, may indicate an infectious disease known as streptobacillary pseudotuberculosis. This disease, which attacks rabbits only occasionally, is caused by a specific germ, *Corynebacterium rodentium*. Death usually follows close upon the symptoms.

**Symptoms.** Weakness, emaciation, lack of appetite, and labored breathing are the usual symptoms.

**Treatment.** No treatment is recommended. Kill the animals and thoroughly clean and disinfect the quarters, feed and water containers, toilet pans, and any nests being used at the time.

**Rabbit fever (tularemia).** This disease is mentioned here only to assure rabbit raisers and consumers that the domestic rabbit is in practically no danger of contracting it. Rabbit fever is a serious bacterial disease of wild rabbits and certain other wild animals, but no case among domestic rabbits appears in the most recent report on the disease. Great care should be used in handling wild rabbits suspected of the disease.

### **Scabby-nose**

This disorder is sometimes responsible for needless culling. It is attended by infection, and usually with bacteria common on the skin. According to Dr. Lund, staphylococcus and related forms are generally present, but often with smaller

numbers of a wide variety of germs in cases of long standing.

**Symptoms.** In the early stages of scabby-nose, the skin near the nostrils or at the margin of the upper lip becomes red or slightly elevated, and whitish areas similar to fever blisters may appear. These symptoms are soon followed by the formation of a thin crust or scab. The margins of the reddish coloration may creep outward to involve some of the furred skin, and hair will be shed. As the scabs increase, much of the bare portion of the nose and parts of the upper lip may be covered with hard crusts, and these are pushed upward by new layers. Usually there is not much itching. Bleeding occurs only when the scabs are broken off deep at the base. The lower lip is involved only on rare occasions.

**Treatment.** A total of about 100,000 units of penicillin is injected into the thick muscles of the hind legs. Penicillin prepared for treating farm animals is usually available in small, rubber-capped bottles, each containing 100,000 units. Dr. Lund states that this amount should be dissolved in 10 cc of sterile saline, available at the same stores that sell penicillin. A sterile syringe and needle should be used to inject the sterile saline into the bottle of penicillin through the rubber cap, which must be wiped off with alcohol. A 5 cc syringe, a 22-gauge needle, 1 inch in length, and a container of fire-resistant glass or enamelware for sterilizing the syringe and needle will be needed. Boil the syringe and needle for five minutes, remove the instruments with sterile tweezers or forceps, fill the syringe with the sterile saline, then plunge the needle through the rubber cap of the penicillin bottle. The saline dissolves the penicillin at once, producing a clear solution ready for use.

The animal must be restrained from struggling. This is done by firmly holding three legs. The person who gives the penicillin draws one hind leg taut to prevent movement of the muscles into which the

needle is inserted. By using alternate legs for successive shots, unusual soreness can be prevented.

The treatment lasts two or three days. By the fourth day, some of the thinner scabs should have fallen, and fresh pink, healthy skin will show beneath. By the end of 10 days the entire scabby area should have cleared up, with new hair starting in the denuded area.

**Snuffles.** This name is applied to one form of pasteurellosis (see p. 41).

#### **Vent disease (urine burn, hutch burn)**

If the delicate membrane near the sex organ or the anal opening becomes chapped, any one of several skin bacteria may cause infection. Since one form of infection, at least, may be fatal (see "Genital Pasteurellosis," p. 42), it is necessary to distinguish between cases with and without the spirochete associated with infectious vent disease.

**Symptoms.** The delicate membrane near the sex organ and sometimes the anal opening are inflamed. Yellowish or brownish crusts may cover these parts, with swelling, cracking, bleeding, or possibly the discharge of pus. The glandular pockets on either side of the vent, which normally contain a moderate amount of thick whitish secretion, may also be affected. In mild cases, if housing conditions are at fault and are corrected, treatment may not be necessary.

**Treatment.** Rub lanolin well into the affected area four or five times a day. In more severe cases, treat the parts daily for four or five days with a mixture of 1 part calomel and 3 parts lanolin. After that, if further treatment is necessary, apply lanolin only for a few days.

**Preventive measures.** Keep the hutch floor dry and clean. Give the corners special attention; if they are neglected, urine burn may develop when urine splashes back upon the rabbit. Solid rails will also cause splash-back; they should not be used in the hutches. If part

of the floor is solid, be sure to keep it clean. Change the bedding about three times a week.

## OTHER DISEASES

**Boils and abscesses.** Lumps or abscesses sometimes appear on different parts of the rabbit's body. Boils on wild rabbits are caused by the larvae of an insect, but most of the boils on domestic rabbits are caused by bruises, by some toxic condition or some infection, such as *Pasteurella* organisms (p. 41), or possibly by the many-headed bladder worm (p. 45). Some authorities consider susceptibility to boils inheritable, but, so far as is known, no organism that would cause abscesses is carried over from one generation to another. Since treatment involves considerable labor and some expense only the more valuable animals will justify care.

**Symptoms.** Boils may come to a head or they may remain as a swelling beneath the skin for some time. If the boil is filled with pus, disinfect the surface with Merthiolate or fresh tincture of iodine, lance the abscessed tissue, express the pus, and swab the cavity with fresh tincture of iodine. Repeat this treatment as long as pus forms. Healing must start from inside the cavity of the wound for recovery.

**Preventive measures.** Sanitation, dry and comfortable quarters, and proper feed, which will aid in building up a natural resistance to disease, are the most promising aids in permanently overcoming such troubles.

### Mucoid enteritis (bloat disease)

This disease is usually considered a digestive disorder. It is apparently not caused by any organism. It may be confused with intestinal coccidiosis because of accompanying diarrhea, but the presence of mucus in the droppings helps to identify it.

Mucoid enteritis affects rabbits of all ages, but most often those under 18 months. Young rabbits of five to eight

weeks may die within 24 to 72 hours. In older animals the disorder lasts longer, but with less mortality. The exact cause has not yet been determined since the disease has not been produced at will by any known experiment.

**Symptoms.** The affected animal first shows lack of appetite. Its eyes are lusterless and its coat dull. Internal pain causes it to grind its teeth. It often shows intense thirst by sitting at the water container and drinking frequently. In time the abdomen becomes distended or bloated. Either constipation or diarrhea may accompany the disorder with mucus voided with the droppings in a high percentage of cases. Autopsy may disclose lesions in the intestines.

**Treatment.** Remove feed and water for about 48 hours, then offer small amounts of fresh green feed. After the fourth day give water once a day in addition to green feed. Leave the water before the rabbit for only a few minutes, then remove the container to keep the animal from drinking too much. Limiting the water intake will help to prevent a recurrence. After about eight days, feed a small quantity of good-quality alfalfa hay, but be careful not to overfeed. Add grain a few days later, and gradually increase the amount until the rabbit is again on full feed.

**Preventive measures.** The use of aureomycin and vitamin B<sub>12</sub> in the feed, as discussed on page 29, has reduced mortality among young fryer rabbits by about 75 per cent.

### Rabbit mange or ear canker (scabies or parasitic otitis)

Ear canker develops during an infestation of the rabbit-ear mange mite. Treated in its early stages it is easily cured. If the mites reach the inner ear, however, pus may form and ultimately kill the rabbit. There are mange mites other than the one causing ear canker, but usually these are not serious in California. All are con-

trolled by the same treatment. Ear cancer will disqualify a rabbit for show.

**Symptoms.** In the early stages, a crust forms inside the ear, and the mange mites are located beneath it. In a case of wry neck, first look for ear cancer. Both wry neck and twisting or shaking of the head to one side may indicate an advanced stage of ear cancer. Apparently the disease is very painful to the rabbit.

**Treatment.** Very gently remove the exuded matter and brown crumbly crusts, resulting from the irritation, with a slender blunt-ended piece of wood—about the size of an orange-wood stick—or a cotton-tipped swab stick. Do not add to the irritation by scraping the tender membrane. After cleaning the ears, apply with a swab or soft brush an antiseptic lotion, such as: 1) 1 part iodoform, 10 parts ether, and 25 parts olive oil; or 2) 0.4 ounce carbon tetrachloride to 1 pint vegetable oil or glycerine. Repeat the application in 6 to 10 days. Lindane has been tested as a cure of ear cancer with promising results, but unfortunately lindane is not always available.

### Skin troubles and insect pests

If rabbits are attacked by fleas or other skin parasites, dust the skin with an insect powder, such as rotenone or pyrethrum. Rub the powder well over the skin. **Do not use DDT dust!** It is a poison which rabbits will swallow as they lick themselves. Where skin troubles are parasitic, treat the animal as recommended for mange mite on page 44.

**Preventive measures.** As a part of the control of skin parasites, clean and disinfect the hutches thoroughly with lye water or with a torch to destroy any possible breeding places of the parasites. Give fresh bedding and, if necessary, fresh straw in the nests.

### Slobbers

Some producers consider slobbers a form of indigestion caused by excessive amounts of green feed or green feed to

which young rabbits are not accustomed. Since drooling may also be a symptom of snuffles (see p. 41), coccidiosis (see p. 39), or bad teeth, be certain that indigestion is the cause.

**Treatment.** If indigestion is the cause, regulate the diet as outlined under feeding (p. 30), with more bulk in the form of wheat bran to help prevent impaction and indigestion. Any change in the diet should be made gradually.

### Worms

Roundworms, tapeworms, and similar pests are not common in a dry, clean rabbitry.

The **roundworm** is expelled in the feces and infects the feed on the hutch floor. The **tapeworm** (*Taenia pisiformis*) has the dog and, less commonly, the cat for primary hosts. The **many-headed bladder worm** is a kind of tapeworm that enters the body with infected feed. The parasite usually locates in the muscles and under the skin, but it sometimes centers in the heart, lungs, and elsewhere in the body. Cysts may form and range in size from that of a pea to an apple. The dog is an intermediate host to the many-headed bladder worm also.

**Another form of bladder worm** attacking the domestic rabbit may be one of the causes of pot-belly, although pot-belly (p. 47) is more often caused by coccidiosis, bloat disease, and indigestion.

**Treatment.** These worms are so uncommon in a sanitary rabbitry that a discussion of treatment is not warranted. The advice of a veterinarian should be sought if they become a problem.

If large cysts form and treatment is attempted, lance the affected area as you would abscesses (see p. 44), drain, and disinfect with fresh tincture of iodine.

**Preventive measures.** Keep the hutches dry and clean. Keep dogs and cats away from the premises of the rabbitry, and do not permit them to sleep on sacks of rabbit feed.

## MISCELLANEOUS HEALTH PROBLEMS

**Cannibalism.** Some does kill and eat their young. This tendency is found most often among young mothers, especially those bred too young. This has been attributed to extreme nervousness, thirst, or an unbalanced ration—especially one insufficient in protein. This may also occur if a doe is a poor breeder or is overly fat. Dispose of does that continue to give trouble after precautions are taken.

Rats sometimes eat small rabbits. Trap or poison the rats, but if poison is used, be very careful that it does not come in contact with the rabbits or the feed.

**Preventive measures.** Rations too low in protein may be improved by adding a good protein supplement and green feed (see p. 31). Salt has been supplied with very good results to poultry to overcome cannibalism.

At kindling, when cannibalism might follow, give plenty of fresh cool water. Let the doe strictly alone and do not examine the young too soon after birth. If they must be examined, place the mother in another hutch until examination is over.

**Constipation.** This usually occurs when too much dry feed is given, although it sometimes accompanies mucoid enteritis (see p. 44). To help prevent constipation, give 2 ounces of green feed daily to adult rabbits and about 1 ounce daily to weaned rabbits. In extreme cases give castor oil as suggested for pot-belly (p. 47).

**Diarrhea (scours).** This is a rather common ailment among young rabbits, sometimes with heavy mortality. It may be the symptom of a serious digestive upset caused by infection or undigested feed in the intestinal tract, which has been attacked by various bacteria. Other possible causes may be excessive quantities of damp greens, feed containing poisonous weeds, musty hay or grain, too early weaning, any condition that lowers the vitality, such as vitamin-A deficiency, un-

sanitary hutches; or it may accompany a serious disease, such as coccidiosis or mucoid enteritis. Coccidiosis, mucoid enteritis, and irregular feeding of large amounts of greens to young rabbits are the most common causes. Very young rabbits stricken seldom warrant treatment.

**Treatment.** Remove the affected rabbit to a separate hutch. Reduce the amount of green feed and try to persuade the rabbit to take scalded milk. A mash of bread in scalded milk is very good. Avoid excessive use of wheat or wheat bran, which contains a laxative protein.

If coccidiosis is the cause, refer to the section on coccidiosis on page 38. If bloat disease is involved, remove all feed and water for a time, as discussed under "Mucoid Enteritis" on page 44. If the cause is poisoning, immediately give 1 to 2 teaspoons of castor oil to empty the small intestine and quickly rid the body of the poison. Withholding feed for a short time after the dosage of castor oil may also help.

If the cause is simple indigestion use 3 to 6 grains of bismuth subnitrate twice a day; or 5 to 10 grains of ordinary baking soda (bicarbonate of soda) in a teaspoon of water twice a day.

**Preventive measures.** Feed to avoid constipation. See that the ration does not contain poisonous weeds, musty hay or grain, or excessive amounts of damp greens. Avoid any deficiency, such as vitamin-A deficiency, that would lower the vitality. Keep the hutches and hutch equipment dry and clean.

**Failure to breed.** This is discussed under the section "Breeding," on page 25.

## Infant mortality and abortion

If a doe aborts, or if the young appear almost lifeless at birth or die without any noticeable cause soon after birth, weak and unhealthy parents are usually the cause. The doe may have been bred too often or allowed to raise too many young. The buck may have been too young for

breeding or allowed to serve too frequently to secure strong offspring.

Another possible cause of infant death may be insufficient milk. A young doe sometimes has difficulty in nursing. She may have tender or sore nipples or caked udders. If so she will tend to scatter the young whenever they begin to nurse. Examine the nipples to see if they are sore; if so, treat them with lanolin. If her condition is normal, hold her until she can become accustomed to nursing. This may overcome the difficulty, but if she persists in refusing the young, or if she scatters them about the hutch, it will be best to get rid of her. If nursing does are frightened by dogs, cats, or predatory animals, try to protect the doe so that she will not drag the babies out of the nest.

A doe suffering from sore hocks (see p. 47) also will fail to nurse her young satisfactorily.

### **Molting (shedding)**

Although molting is not a disease, special care is needed during the first molt, which comes at about six to eight weeks of age. Give the rabbits plenty of well-balanced feed, with a small amount of protein added to help form a good coat. Many breeders add whole flaxseed or extra oil meal to the ration at time of molt. A molting rabbit is not in proper physical condition to be bred.

### **Paralysis and leg weakness**

Paralysis usually attacks the hindquarters and causes the rabbit to move with great difficulty. Several conditions may cause both paralysis and leg weakness: injury when rushing about the hutch if frightened by dogs, cats, or other predatory animals; too frequent breeding, or nursing too large a litter; and infection at time of kindling, when the nerve centers controlling the muscles of the hind-quarters are hopelessly affected.

Leg weakness or rickets in young rabbits is caused by deficient calcium assimilation. Where a ration is so deficient in

vitamin B<sub>1</sub> that paralysis results, the trouble can be quickly overcome by feeding adequate amounts of whole grain, especially the germ part of the grain, and by feeding only high-grade alfalfa hay which contains a small amount of this vitamin. In an emergency add high-grade yeast to supply vitamin B<sub>1</sub>.

### **Pot-belly**

This trouble is found primarily among the young. It may be caused by too much damp or wet green feed or by musty hay and grain. Too much crude fiber in the ration may also be a cause. If the young are weaned too soon, they may be unable to digest the bulkier feed and excessive amounts of greens. In all of these cases the abdomen becomes swollen and pendent. If intestinal coccidiosis or mucoid enteritis is suspected, refer to these diseases.

**Treatment.** Reduce the amount of feed if necessary. Give affected rabbits 1 to 2 teaspoons of castor oil, according to their size and age (see p. 38). In mild cases place a few drops of castor oil in the feed. **Do not give wet or musty feed or damp or wet greens.**

See that the rabbits have plenty of exercise. This calls for a hutch large enough for them to move about easily.

### **Sore hocks**

If a rabbit's hocks are bruised or chafed, they may become infected. The pain that follows is intense. Rabbits, especially those of nervous temperament, often tread or stamp with the hind feet even while sitting. If moisture, urine, and filth are allowed to collect in a hutch, the footpads will soon become infected. Heavy rabbits with dense and long fur on the footpads are most subject to sore hocks. A doe so affected will not properly nurse her young. The life of breeding animals will be shortened.

**Symptoms.** The rabbit will rest in a position to relieve the injured parts of the hind feet. Inflamed or ulcerated areas

may appear on the underside of the hind feet and bruised places—possibly on the pads and toes of the forefeet. In time the rabbit will lose flesh through suffering. In advanced stages the hair over the injured parts may fall out, and a scaly crust may develop. Sometimes this is accompanied by bleeding. Pus may then form in the swollen area, sometimes draining without lancing.

**Treatment.** Treat the affected parts with zinc or iodine ointment every other day until healing is well advanced. Keep the hutch floor scrupulously clean. Keep solid floors bedded with clean straw, and place a lath platform, a piece of linoleum, or a flat board over floors of wire mesh or hardware cloth to ease the sore parts. In some cases, if it is possible to remove the affected doe to a pen with dirt floor, recovery will be more likely to take place. If the front feet are affected it is best to dispose of the animal.

**Preventive measures.** Select rabbits of quiet disposition to replace high-strung animals. Prevent any disturbances by natural enemies of the rabbit, such as the dog, cat, snake, and opossum. Avoid feeding young rabbits beyond the weaning age too heavily on concentrate feed which would cause excessive weight and greater susceptibility to hock injury.

Keep the hutch, hutch equipment, bedding, and nests dry and clean at all times. Provide a smooth place on which the rabbits can rest, such as a wide, flat board or a piece of linoleum.

### **Malocclusion (buck teeth)**

The large incisor teeth must meet at the correct angle and wear normally or they become very long. This condition is known as malocclusion or buck teeth. It can be recognized easily when the rabbit is weaned at two months of age. Breeders should examine all young rabbits that are to be retained or sold for breeding. Since malocclusion is hereditary affected animals should not be retained for breeding purposes. So that the animals can eat

properly and attain good condition for slaughter, cut back the long incisors periodically to normal length with a pair of sharp, side-cutting pliers. Malocclusion caused by abscesses should not be confused with the inherited type (Templeton, 1944).

### **Sudden death**

Beginning operators especially may have some trouble determining the cause of sudden deaths. When several animals die suddenly at the same time the cause may be excessive heat or feed that is too coarse or possibly poisonous. Carefully check all conditions in the rabbitry to determine the cause and to correct it.

Pathological laboratories are located in various sections of California, where poultrymen take birds for examination. Some of these laboratories may also be willing to examine rabbits to determine the cause of sudden death.

Veterinarians will also make such an examination for a fee. Only the more valuable animals will justify such an expense but where serious losses have been taking place, advice should be sought. Veterinarians who work with rabbits will most likely recognize causes of sudden death; therefore, their help and advice can be a very cheap investment in lowering mortality. Once the more important causes of losses are determined, prevention can be planned more easily.

### **Wounds**

Clean wounds with warm water and pure soap, then treat with a disinfectant. In severe cases, where the skin has been torn, clean the wound and treat with 2 per cent Merthiolate or 2 per cent fresh tincture of iodine. With a sterilized needle and sterilized fine silk thread, take as many stitches as are necessary to bring the edges of the wound together. Tie each stitch separately, and leave threads long enough to find easily and remove about a week later. Keep the wound disinfected until healing starts.

## **PREPARING MEAT, PELTS AND FURS, AND WOOL FOR MARKET . . .**

The preparation of rabbit products—meat, pelts, furs, or wool—for market requires a great deal of skill. A producer needs to learn the special techniques in each field and to know what methods should be used and what ones should not be used.

### **MEAT**

**Killing.** Hold the animal on a bench or a table and stun it with a quick blow behind the ears. Use a small heavy stick or a small iron bar. Immediately after stunning, cut the jugular vein in the throat with a sharp knife to bleed the animal; then fasten the carcass to a line nail or a hook to complete the bleeding. A special gambrel is sold for hanging rabbits during dressing, but a homemade one will serve just as well. Hooks fastened to a strip of wood will also serve.

**Dressing.** An experienced rabbit butcher can easily dress from 60 to 100 or more rabbits per hour if a helper brings the animals in and handles the removed pelt. After removing the pelt, slit the carcass down the length of the abdomen, starting near the tail. Cut around the anal opening and through the juncture of the pelvic bones; then, with a gentle backward bend of the legs, pry apart the hindquarter to expose the lower intestine. Follow on down the abdomen with the knife and remove the entrails, but leave the liver and the kidneys embedded in the fat along the back. Remove the stomach and lungs, and sever the feet with pruning shears. Wash the carcass if necessary, then dry and cool it until the body heat is gone. **Never chill the dressed rabbit until the body heat is entirely gone.**

Some dressing establishments throw the carcass into cold water and, after it has cooled, pack it in ice. If a carcass is soaked in cold water, it should remain only long enough to be cooled.

For local trade the ribs may be broken to flatten the chest and make the animal look less lifelike. A few sprigs of parsley

and a neat wrapping of oil paper or cellophane will make a dressed rabbit look very appetizing. Special cartons are sometimes used to display rabbit meat cut up for cooking. The American Rabbit Breeders' Association is able to supply these rabbit meat cartons through their Supply Department, 4323 Murray Avenue, Pittsburgh 17, Pennsylvania. Rabbit meat posters are also listed. In the cutout areas in the top the best cuts are placed to attract the retail customer.

In the preparation of rabbit meat, one method should be discouraged by producers. This method, called hog-dressing, is used on imported rabbits that are already drawn upon arrival. The abdomen is open, but the pelt remains to prevent the meat from turning dark in storage. This method offends customers who have kept rabbits as pets.

### **PELTS AND FURS**

This section on grading and tanning is furnished for rabbit raisers who may be interested in the home tanning and use of pelts, even though most commercial producers are not concerned. Pelts can be saved almost as easily as they can be discarded. The pelts should be saved from all rabbits dressed at home. Those on rabbits sold alive to dressing plants are usually saved by rabbit butchers.

**Grading of furs.** The larger fur dealers usually have about six grades, based primarily on color, condition, and size (table 8). Certain colors, such as white, Chinchilla, Havana, and Lilac are very popular. The fur producer should become acquainted with the best color for the breed concerned. Condition involves fur quality, molt, and pelt treatment. The

Table 8. FUR GRADES

Item	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Color.....	Perfect	Perfect	Fair	Perfect	Perfect	
Size.....	Large	Large	Large	Large	Small	
Hair.....	Dense and soft	Dense and coarse	Dense and soft	Unprime	Dense and soft	Hatters'

characteristics of the six fur grades sometimes used commercially are shown in table 8.

The highest prices are paid for large pelts with soft, dense fur 1 to 1½ inches long. The color of the fur should be uniform and the pelt free from hutch and blood stains, sun injury, and molt. The pelt must be taken at the right time and properly handled to meet all of these requirements. Poorly dried, wormy, torn, or soiled pelts are practically valueless. The simple fact that the pelt is from a Chinchilla, a Havana, a Lilac, or one of the popular white breeds is no indication that it will bring any more than butcher-run prices if these requirements are not met.

**Fur quality.** The quality of the hair is very important. A pelt with coarse, stiff, dull hair has little value. This condition may be caused by too much barley, milo, or corn in the feed, or it may come from faulty breeding. In summer, pelts tend to be thin haired. In the cooler months, high quality is more easily secured. Dense fur at that time will have up to 50,000 hairs per square inch. In the winter months fur prices are usually best.

Molt can quickly lower the value of the finest pelt. It is usually indicated by a break in the ticking (guard hairs); if the pelt does not show ticking, gently pull the fur near the rump to see if there are loose hairs. Blowing into the hair may disclose new hairs at the base near the skin, which would indicate molt. A dark discoloration of the skin before or after dressing is also an indication of molt.

The first molt starts when the rabbit is six to eight weeks old. Young meat rabbits between two and three months may have fair pelt quality during the winter. The pelt should then be in good condition again when the rabbit is about five and one half to six months old. The best pelts are usually taken from rabbits approaching six months of age between October and April.

**Treatment of pelt.** If the pelts are to be saved for the market, slit the animal down the inside of the legs and around the neck with a small knife. Then peel the pelt down over the legs and hindquarters, starting at the hock joint and stripping from the body, leaving the flesh side out. Use a knife, where needed, to separate the skin from the flesh and fat, especially along the abdomen. Cased skins are very easily removed and treated, and are preferred on the market. Skins slit down the front are salable but are not so desirable. They are much harder to stretch for drying.

**Stretching.** Special wire stretchers are sold for stretching cased skins during the drying process. Wire stretchers can easily be made with 8- to 10-gauge galvanized wire, preferably without a loop at the top. A board can be used instead of wire, but drying is slower. All four legs should be placed on one side of the stretcher and the back of the pelt on the other side. Clothespins may be used to hold the pelt in place on the stretcher.

**Tanning.** The general rabbit producer is neither equipped nor trained to tan rabbit pelts properly. Pelts to be sold

therefore should not be tanned before shipment. Only those pelts intended for home use should be tanned.

For tanning, slit the cased skin down the belly and soak it in several changes of clean cold water for two or three hours. Longer soaking may loosen the hair. As soon as the skin is softened, spread it over a rounded stretching board or pole and remove all adhering tissue, flesh, and fat with a file or a dull knife. This treatment also aids in working out the grease and oil.

When the skin is softened and clean, work it further, this time in lukewarm water containing 1 ounce of baking soda or borax to each gallon of water and  $\frac{1}{4}$  ounce of powdered soap. Rinse the skin thoroughly in lukewarm water and gently press out the water. Next, work it in high-grade gasoline to remove the last particles of dirt and grease. Be careful about fire while using the gasoline. When the gasoline has evaporated, the skin is ready for tanning.

Two methods of tanning are used for rabbit skins—the salt-acid process and the salt-alum process. The salt-alum process may require a little more working than the salt-acid process to make the skin soft and pliable, but it is considered a somewhat more satisfactory process.

**The salt-acid process** calls for a solution of 1 pound of common salt and  $\frac{1}{2}$  ounce of concentrated sulfuric acid to each gallon of warm water. First dissolve the salt, then gradually pour the acid **into** the salt water, stirring constantly. **Never pour the salt solution into the acid!** Use a container made of glass, clay, or wood, but not metal, which could be eaten by the acid. **Do not inhale the fumes nor spill any of the liquid on skin or clothing while it is warm.** When the solution has cooled, it is ready to use.

Leave the skin in the solution until it is entirely covered. This will take one to three days. Stir the solution frequently to insure even treatment of the pelt. Finally,

remove the pelt and rinse it in clean cool water. Work it then for about 10 minutes in a solution containing 1 ounce of borax dissolved in 1 gallon of water. Rinse the pelt again in clean water and press it as dry as possible without a wringing movement. Rub and pull it for a few minutes by hand, then tack it flat, flesh side up. Apply to it a thin coating of fresh butter, neat's-foot oil, or olive oil. Cover the paste lightly with paper or burlap to prevent rapid drying. Leave this covering until the skin is dry.

While the skin is still slightly damp, begin to work it by hand, stretching and pulling it back and forth over the stretching board or pole. If the skin is rough, work it over a sandpaper block until it is soft and pliable. Good tanning is dependent on a thorough working of the skin while it is drying. If the skin is too hard and rough after drying, dampen it and work it again. Any residue of grease can be removed with gasoline. Finally, work



Fur stretchers made of #8-gauge galvanized wire are used to stretch the pelts until they are dry.

the skin in dry hardwood sawdust to give the fur a luster.

**The salt-alum process** calls for 1 pound of ammonium aluminum sulfate or potassium aluminum sulfate dissolved in 1 gallon of cold water. Place 4 ounces of crystallized sodium carbonate (washing soda) and 8 ounces of common salt in  $\frac{1}{2}$  gallon of cold water. Slowly pour the soda-salt solution **into** the alum solution while stirring vigorously. Next mix the combined solutions with enough flour—already mixed with a little water to prevent lumping—to make a thin paste.

The rabbit skin should be clean and soft before this paste is applied. Tack the skin smoothly, flesh side up, on a board. Apply to it a  $\frac{1}{8}$ -inch coat of the tanning paste and, as in the salt-acid process, lightly cover the paste with paper or burlap to prevent rapid drying. The next day scrape off most of the paste and apply a second  $\frac{1}{8}$ -inch coat, as before, again covering to prevent drying out.

Repeat this process two or three times, depending on the thickness of the skin. The thick skin of a buck may require three treatments, but two treatments should be sufficient for the thin skin of a young rabbit. Leave the last paste coating on for three or four days, then remove it by scraping. Now work the skin in borax water (1 ounce of borax to 1 gallon of water), rinse, and gently squeeze out the water. Work the skin by stretching and pulling as described for the other process, and finally work it in dry hardwood sawdust for luster.

**Use of furs.** It is not possible in this circular to describe the manufacture of fur garments from tanned rabbit pelts. The producer will nevertheless need to know something about the use of furs.

Rabbit furs have been sold under various trade names, but recent laws prevent the use of names that do not indicate the nature of the pelt.

Skill in fur-garment manufacture is due to years of experience by the established furrier and to the mechanism of the fur-

sewing machine which sews patches invisible from the outside. A person who does not have special machinery should not attempt the manufacture of fur garments. The result shows lack of skill.

## WOOL

**Grading of wool.** All wool must be cleaned before it is plucked or clipped. Stained ends must be cut off and tiny specks brushed out before shearing. If the wool is badly matted it should be clipped and destroyed. Small mats or tightly webbed wool should not be found in any grade except No. 4 or, if soiled, No. 5. All wool should be graded at the time it is plucked or sheared and kept separated in suitable cardboard cartons or paper sacks inside of cloth sacks. Cramming wool into a container may cause it to mat and grade out as No. 4.

The wool is graded according to length:

<i>Name of grade</i>	<i>Length of wool fiber</i>
Plucked No. 1	3 inches or longer
Plucked No. 2	2 inches up to 3 inches
Super	more than 3 inches long
No. 1 sheared	$2\frac{1}{4}$ to 3 inches
No. 2 sheared	$1\frac{1}{2}$ to 2 inches
No. 3 sheared	1 to $1\frac{1}{2}$ inches
Shorts	$\frac{1}{2}$ to $\frac{3}{4}$ inch
No. 4	large or small clean mats
No. 5	soiled wool

Angora rabbit wool is usually clipped once every three months. It grows about an inch a month. Mills normally prefer wool  $2\frac{1}{2}$  to 3 inches long. The first clip, at three months of age, amounts to approximately 1 ounce.

**Use of Angora wool.** It is used in the manufacture of yarn for sportswear, such as sweaters and scarfs, is woven into fabrics and sold as bunny cloth, or is spun with wool and sold as Angora knit. Dealers call these various products "rabbit's hair cloth" or "rabbit's hair fabrics," but in all instances Angora rabbit wool is utilized, not ordinary rabbit hair. Some fabrics are manufactured in Europe and exported to this country.

## MARKET ORGANIZATIONS AND MARKETING . . .

Producer and buyer depend on each other and on the marketing organization for success; the marketing organization in turn must be assured of a dependable supply before it makes a selling contract with a buyer.

### MARKET ORGANIZATIONS

A large producer devotes his entire time to production and must, of necessity, turn his marketing over to a hired agent, or buyer. This means that he does not have direct contact with the markets. As production exceeds local demand, he must go outside his district to equalize supply and demand, but he is too busy as an operator to establish these markets himself. Rabbits have usually been marketed on a locality rather than on a commodity basis. The operator has therefore often suffered low prices simply because he did not have the time to extend his market beyond his locality, and because there was no organization, or he had not associated himself with an organization that could perform this service for him. True, some producers have actively tried to improve marketing conditions through their local producers' association, but better facilities are still needed in most areas. The producer must have a dependable market or he will fail.

The buyer of rabbit products is also vitally concerned with the development of a dependable market. Producer and buyer are dependent upon each other for adequate production and successful sales, and both are dependent upon the selling organization.

Any selling organization, in turn, must be assured of a dependable supply before making a selling contract with a buyer. An estimate on supply, however, has been difficult to get because coöperation among producers has been lacking. The organization best qualified to estimate supply is a group of rabbit breeders, but until producers are willing to work together, lack of coöperation in furnishing an estimate on supply will cause prices to fluctuate

and markets to be uncertain. High winter prices will still tend to reduce consumption, and lower summer prices, to reduce production.

**Producers' associations.** Producers should work together to improve the marketing conditions in all branches—for instance, in both meat and fur, where present market demands are large enough to take care of a fairly heavy production. True, the sale of meat may depend on appetites and the sale of fur on styles, but markets can still be developed which will warrant a considerable increase in both lines of production.

**Coöperatives.** Many of the successful branches of agriculture are now based on individual production and collective marketing and financing. According to recent studies of coöperative marketing, control of supply and ability to dictate prices are not essential to the operation of such an organization. A coöperative should comprise only those producers who believe in coöperative marketing.

A number of California coöperatives are selling branded products with excellent results. A well-graded product of high quality put out under a reputable association brand will in time reflect to the credit of all members. For example, a dry pack of well-graded, high-quality rabbit meat, possibly sold in attractive cutout cartons under the coöperative's brand should appeal to buyers wanting a fine product. The big problem of surplus may be partly met through this outlet.

Some rabbit producers may be interested in organizing coöperative marketing associations. Considerable information on the subject has been collected by the Collège of Agriculture of the Univer-

sity of California for use as a guide in such an undertaking.

Producers outside the coöperative will probably benefit very little from the organization's services and brand, but, in time, some may see the need of coöperating. Other producers can work through selling firms, realizing, of course, that they will usually be forced to take whatever prices are offered. Still others may contribute to the pooling of the output in a district and selling through reputable buyers, a plan which has been fairly successful, especially in avoiding the high investment involved in packing privately.

Some progress has been made in bringing about orderly and seasonal distribution of fryer rabbits. Trucks of large capacity are now being used to haul meat rabbits to market. Shipment of this type is being done from southern California to large eastern cities. Two plants now are under United States Department of Agriculture inspection and others may be soon. This permits approved plants to sell to the armed services as well as to other outlets. Such shipments insure a better distribution and prevent seasonal market gluts, especially at the time when spring fryer chickens are in heavy supply. Such improvements in distribution should be encouraged, because everyone is benefited by orderly marketing.

## **MARKETING MEAT, PELTS AND FURS, AND WOOL**

**Meat.** Most of the live rabbits marketed in this state are collected by trucks sent out weekly or twice a month from large killing establishments. The high express rate on live meat rabbits, which is almost double that on live poultry, makes shipping by express rather expensive. Organized rabbit raisers have tried to have the commodity rate applied to live meat rabbits, as it is to live poultry, but the decision was against lowering the present rate. The lowest rate may be secured by keeping the valuation down on the shipment.

Many rabbit raisers do their own killing, but sell on a basis of live weight. Home dressing of rabbits will usually bring the producer somewhat greater profit than marketing alive. The producer who does his own killing and dressing is in a position to guarantee his product. However, it should be remembered that only a very small and unstable industry can be built upon direct and independent marketing.

Commercial rabbit butchers must satisfy all sanitation and health regulations of the state and county.

**Pelts and furs.** Marketing pelts and furs does not mean so much the selling of a few for special orders at a fancy price. It is the collection and sale of pelts in lots of a thousand at a time. New York buyers of Pacific Coast furs are the most reliable. Buyers in St. Louis, Chicago, and the Pacific Northwest are also active. Fur-buying companies have been formed in both central and southern California. Agents of these local companies, as well as of eastern companies, take practically all of the marketable pelts. The commission for selling furs is usually 10 per cent of gross sales. Cost of shipping is extra.

Local buyers are inclined to have fewer grades of pelts than large eastern buyers, and naturally the local price must be enough less to cover the cost of grading and shipping to the eastern markets.

A few furs are being used in California, especially by some of the larger firms that can afford to employ a furrier. California rabbit producers need a fur-cutting company to buy hatters' pelts for the manufacture of hatters' fur. This would save needless expense in shipping hatters' pelts long distances. The outlook in California is for an increasing interest in rabbit furs by local manufacturers.

**Wool.** Some American dealers handling rabbit pelts also take Angora rabbit wool. Moreover, the Federation of American Angora Breeders and the American Angora Rabbit Breeders' Coöperative market this wool for their members.

Early in 1940 the American Angora Rabbit Breeders' Coöperative informed its members that since the market for Angora rabbit wool is seasonal, the wool must be stored during off seasons. As soon as a member sends his wool to coöperative headquarters, the wool is graded, and he receives a cash advance. Wool that is placed in a bonded warehouse where

it is insured against all possible losses is security for advances, but final payments await the sale of the wool delivered. The same coöperative has a mill where rabbit wool is used with sheep wool to produce various kinds of yarn and cloth.

Angora wool can also be made into yarn at a mill and sold direct to department stores.

## BUSINESS ASPECTS OF THE INDUSTRY . . .

To secure a fair return on his investment, an operator must know what is considered a reasonable cost for each item of operation. He must also know the relation between the different items involved. Then, to be able to use this information, he must keep accurate records.

### COSTS

**Average investment per doe.** The Enterprise-Management studies showed that rabbits require a greater investment per dollar gross income than poultry. Compared with poultry, they require a smaller percentage of the total investment in land, about the same in buildings, less in equipment, and more in stock. Feed and land costs are usually greater near the large cities, although they are offset, in part, by a better market if direct marketing is feasible.

Land, buildings, equipment, supplies on hand, and rabbit stock were valued at \$32.00 per doe in the Southern California Rabbit Management Study for 1947. For 1952 in Los Angeles County the investment averaged about \$22.38 per doe. Investment in land and equipment—not including animals—in 1951 in San Bernardino County was \$14.43; and in 1952 in Los Angeles County, \$14.93.

**Housing and housing equipment.** These costs vary too greatly to furnish accurate figures. Materials and labor for some of the modern 4- to 6-compartment wooden hutches cost from \$16.00 to \$20.00. The housing and equipment charge in southern California for 1947 was 49 cents per doe.

**Labor.** Increased efficiency in the use of labor has not been sufficient to over-

come the increased hourly labor cost—from 28 cents in the 1930-1939 period to 77 cents in 1946, 76 cents in 1947, 84 cents in 1948, and \$1.00 in 1951. The total annual labor cost per doe increased from \$4.49 in the 1930-1939 period to \$9.11 in 1946, \$10.13 in 1947, and in 1951 averaged \$10.69 per doe in Los Angeles County. A reasonable figure under recent price conditions is about \$10.00 per doe.

In terms of farm income—total earnings from management, labor, and invested capital—\$9.14 for 10.7 hours of labor per doe in 1951 for Los Angeles County represent an average of about 86 cents an hour. For San Bernardino County in 1951 farm income of \$11.45 for 5.9 hours was more than \$1.90 an hour, due largely to the greater labor efficiency.

**Feed.** The annual feed cost per rabbit sold in 1951 was 76.4 cents in Los Angeles County and 74.8 cents in San Bernardino County. This involved a total feed cost per pound of meat of 18.2 cents in Los Angeles County and 17.5 cents in San Bernardino County (table 9). Each doe in Los Angeles County averaged 121 pounds of meat rabbits, and in San Bernardino County, 108 pounds, both excellent averages and probably well above the general state average.

Rabbit management studies in San Ber-

Table 9. FEED COSTS PER POUND IN LOS ANGELES AND SAN BERNARDINO COUNTIES, 1951

Counties	Feed	Labor	Other costs	Total costs
Los Angeles.....	(cents) 18.2	(cents) 8.8	(cents) 0.8	(cents) 27.8
San Bernardino.....	17.5	5.4	1.8	24.7

nardino County in 1951 showed an average price of \$3.87 per hundredweight, involving 99.8 per cent pellets, costing 3.87 cents per pound. It took an average of 4.9 pounds of feed for each pound of meat sold. The over-all average was 414.6 pounds of pellets, 50.0 pounds of hay, and 57.6 pounds of grain per doe annually. The total average feed consumption per doe in Los Angeles County for 1951 was 567.0 pounds, or 4.7 pounds of feed per pound of meat produced. Such averages show what is considered reasonable among commercial fryer rabbit producers under existing conditions.

**Miscellaneous expenses.** In addition to the cost of feed, labor, and rabbits bought, there has been a slight expense for such items as taxes and water. These other costs may be roughly estimated at 1 to 2 per cent of the total cost (see table 10).

### PER POUND INCOME SOURCES

**Meat.** The total expense per doe, including feed, labor, rabbits bought, miscellaneous, depreciation, and interest at 5 per cent, was \$36.28 in 1951 for Los Angeles County for an average of 121 pounds of meat produced. The cost in San Bernardino County was about \$26.68 for 108 pounds of meat per doe, live-weight basis. The total cost per pound in 1951 amounted to 27.8 cents in Los Angeles County and 24.7 cents in San Bernardino County.

**Pelts and furs.** The income for pelts and furs per doe is usually so low that no cost per pound can be given for pelts and furs. Practically no rabbit pelts are sold by fryer rabbit producers; instead, the rabbits are sold alive.

**Wool.** No recent figures for the value of wool sold are available and none for

Table 10. PERCENTAGE DIVISION OF COST AND INCOME ITEMS FOR LOS ANGELES COUNTY, 1951

Costs		Income	
	(per cent)		(per cent)
Feed.....	61	Fryer rabbits sold.....	90
Labor.....	29	Hides, manure, et cetera.....	1
Miscellaneous.....	3	Breeding stock.....	2
Depreciation.....	4	Old rabbits sold.....	3
Interest.....	3	Increase in inventory.....	4

Note. In reviewing such percentages, it should be remembered that they will vary from year to year and from rabbitry to rabbitry. For example, in San Bernardino County 1951 feed costs amounted to 71 per cent and in 1950 to 60 per cent. Such variations are normal, and yet the producer should have in mind some standard of efficiency when considering the management of his rabbitry.

the cost of production per pound. In past years the costs have been highly variable.

## RETURNS

Through greater production efficiency the net farm income per doe has increased from \$2.72 in the 1930-1939 period to \$9.14 for Los Angeles County and \$11.45 for San Bernardino County in 1951.

In Los Angeles County, where the 1930-1939 average was recorded, production efficiency was not sufficiently great in 1947 to overcome the higher cost of feed, labor, and miscellaneous items, so there was a management loss compared with 1946. However, in 1948 the management income per doe was \$1.27.

Management income is the income after deducting for labor (including operator's labor), depreciation, and interest, whereas farm income takes out only for cash expenses. In Los Angeles County in 1951, depreciation per doe amounted to \$1.35 and interest to \$1.19 at 5 per cent. This left a management income per doe of 54 cents. In San Bernardino County, where results were a little better, the management income per doe amounted to \$4.87.

**Meat.** Since 1930 many annual records have been compiled, most of which were on meat rabbitries. Table 11 presents a general summary of meat rabbit production. It shows that the average price for fryers sold was only 12.7 cents, wholesale, live-weight basis, in the 1930-1939 period in Los Angeles County, but rose to 26.8 cents in 1945; to 27.4 cents in 1946; 27.4 cents in 1947; 31.2 cents in 1948; and 32 to 33 cents in early 1949. Live-weight prices at the ranch in southern California in December, 1952, were 25 to 28 cents a pound. The figures for the different years given in this column were compiled from records of southern California coöperators.

**Pelts and furs.** The records in the Southern California Rabbit Management studies show that the pelts of fryer rabbits net very little. Since most of the fry-

ers and old breeding stock sold for meat are sold alive, the operator receives little income from fur or pelts. If a white fryer sold for an average market price of approximately \$1.18, a value of about \$1.11 for meat and 7 cents for pelt was allowed in 1951.

White butcher-run pelts were listed at 80 cents a pound (5 to 7 pelts per pound) in southern California late in February, 1953. Hatters were quoted at 30 cents per pound. Colored butcher-run pelts were listed at 15 cents per pound; does and bucks at 10 cents per pound, and hatters at 5 cents per pound. Heavy medium white pelts were listed at 17 cents each; large No. 1 doe pelts at 25 cents each; large No. 2 doe pelts at 15 cents each; and large buck pelts at 20 cents each.

**Wool.** In 1952 the cash advanced on the best grades of Angora rabbit wool was relatively low (see p. 7). While those engaged in the coöperative marketing of the wool are doing an excellent job, the prospective grower of Angora rabbits is still faced with a serious marketing problem, with the total income rather uncertain as compared with the income from fryer rabbits.

**Breeding stock.** Breeding stock usually brings much more per pound than fryer rabbits. In 1951, rabbitries in San Bernardino County reported values per pound ranging from a minimum of 41.9 cents to a maximum of 69.5 cents and an average of 66.3 cents a pound. Pedigreed, mature rabbits often bring \$10.00 to \$15.00 or more in sale; the average given above, however, is somewhat less.

**Manure and biological specimens.** No separate figures for the value of rabbit manure are available. Few producers report any great sale.

A few rabbits have been sold for biological specimens at prices ranging from \$1.00 to \$1.25 or more each, at 4 pounds live weight. Rabbits used for pregnancy tests usually bring no more than normal meat prices; such sales therefore cannot

**Table 11. GENERAL SUMMARY MEAT RABBIT ENTERPRISES FOR THE COUNTIES OF LOS ANGELES AND SAN BERNARDINO FOR THE PERIODS 1930-1939, 1945-1950, AND 1951**

(Reports based on the Agricultural Extension Service Enterprise-Management Studies)

	Ten-year average 1930-1939	Six-year average 1945-1950	Average 1951
<b>General</b>			
Number of records			
Los Angeles County.....	9.0	13.5	10.0
San Bernardino County.....	*	*	5.0
Average number of does			
Los Angeles County.....	67.0	126.0	139.0
San Bernardino County.....	*	*	964.0
Number of kindlings per doe			
Los Angeles County.....	3.2	3.9	4.7
San Bernardino County.....	*	*	4.0
Number raised per doe yearly			
Los Angeles County.....	16.7	23.3	28.0
San Bernardino County.....	*	*	23.9
Pounds of live rabbit raised per doe			
Los Angeles County.....	65.0	104.4	121.0
San Bernardino County.....	*	*	108.0
<b>Mortality—Los Angeles County</b>			
Percentage of older stock.....	19.1	38.3	42.1
Percentage of young stock.....	23.0	26.2	23.1
<b>Prices</b>			
Average price per pound of fryers sold			
Los Angeles County.....	12.7 c	27.0 c	30.0 c
San Bernardino County.....	*	*	29.4 c
Average price per pound of meat produced			
Los Angeles County.....	14.0 c	26.7 c	28.7 c
San Bernardino County.....	*	*	*
Average price of old meat animals			
Los Angeles County.....	*	*	*
San Bernardino County.....	*	*	14.7 c
Average price of breeding stock			
Los Angeles County.....	*	*	*
San Bernardino County.....	*	*	66.3 c
<b>Feed</b>			
Pounds of feed per doe			
Los Angeles County.....	403.0	499.0	567.0
San Bernardino County.....	*	*	522.2
Pounds of feed per pound produced			
Los Angeles County.....	6.2	4.8	4.7
San Bernardino County.....	*	*	4.8

Table 11—Continued

	Ten-year average 1930-1939	Six-year average 1945-1950	Average 1951
<b>Feed—Continued</b>			
Price of pellets per cwt.			
Los Angeles County . . . . .	*	*	*
San Bernardino County . . . . .	*	*	\$ 3.83
Average feed price			
Los Angeles County . . . . .	*	*	*
San Bernardino County . . . . .	*	*	3.60
<b>Costs per doe</b>			
Feed costs			
Los Angeles County . . . . .	\$ 5.83	\$ 17.77	\$ 22.04
San Bernardino County . . . . .	*	*	18.80
Labor costs			
Los Angeles County . . . . .	4.49	10.14	10.69
San Bernardino County . . . . .	*	*	5.90
Miscellaneous costs			
Los Angeles County . . . . .	0.47	0.86	1.01
San Bernardino County . . . . .	*	*	*
Depreciation per doe			
Los Angeles County . . . . .	0.51	1.12	1.35
San Bernardino County . . . . .	*	*	*
Interest at 5 per cent			
Los Angeles County . . . . .	0.79	1.23	1.19
San Bernardino County . . . . .	*	*	*
Total expense			
Los Angeles County . . . . .	12.09	31.12	36.28
San Bernardino County . . . . .	*	*	26.68
<b>Income per doe</b>			
Sale of fryers			
Los Angeles County . . . . .	*	\$ 25.37	\$ 32.67†
San Bernardino County . . . . .	*	*	29.62
Total farm income			
Los Angeles County . . . . .	\$ 2.72	9.13	9.14
San Bernardino County . . . . .	*	*	11.45
Management income			
Los Angeles County . . . . .	-2.51	-1.83	0.54
San Bernardino County . . . . .	*	*	4.87
Income above cash costs			
Los Angeles County . . . . .	3.23	10.09	10.49
San Bernardino County . . . . .	*	*	*

\* Indicates no figures available.

† Estimated at 90 per cent fryers sold out of total pounds produced per doe.

be safely figured for more than the going rate for meat rabbits.

## RECORDS OF OPERATION

Very few rabbit raisers really know if they are making a profit. A well-kept record book will indicate this at any time. This book should hold records of litters, breeding rabbits, receipts, and expenses. Such records are very important and should be kept by all commercial producers.

**Pedigree blanks.** Pedigree blanks and hutch record cards can be secured from most rabbit-supply houses. Pedigree blanks, which come in pad form, have spaces in which to record the ancestry of a rabbit back to the great-grand-sires and great-granddams. There are also spaces for date of sale, name of breeder, registry number of each rabbit recorded, and the color. The weight of the rabbit, its name, weight of sire, weight of dam, dis-qualifications, if any, date of breeding, animal to which bred, and number of the pedigree blank are important items on the pedigree. The name and address of the breeder should also be affixed to this blank. A duplicate of the pedigree should be kept when a sale is made.

**Hutch records.** Keep hutch records in duplicate. Fasten the original record card

on the outside of the hutch door or feeder so that it will not be eaten by the rabbits. A hutch record, such as that shown, has spaces in which to write the time of breeding, time of kindling, number in the litter, deaths, and any other necessary information on the rabbit. Rabbit supply dealers can furnish forms of this kind, or forms can be prepared at a local printing shop.

**Ledgers.** Simple debit and credit ledgers are available at any bookstore. On the debit side show the amount and cost of feed used, rabbits purchased, improvements, bills payable, and other items of expense. On the credit side show number of pounds of meat sold and price; number and quality of pelts and furs sold and price; number of pounds of wool sold and price; breeding stock sold and price; and miscellaneous rabbit products and price.

**Inventory.** Take an inventory of stock and equipment during the slack months. The inventory should show the value of permanent improvements and fixtures, real estate involved, equipment, livestock, increase in inventory, and products on hand. If improvements are necessary, the producer must first know where he is inefficient, and he cannot know this without a record of his operations.

The sample hutch record card shown on the following page can be purchased at a rabbit supply house or can be prepared at a local printing shop.



**Table 12. A STANDARD OF CAPITAL INVESTMENT AND COSTS WITH INCOME FROM A WELL-MANAGED 250-DOE RABBITRY**  
**(Production at the rate of 23.5 young or 105.8 pounds of fryer rabbits per doe)**

Capital investment	Original cost	Average value	Interest at 5 per cent	Depreciation	For 250 does		Per pound, in cents
					In dollars per doe		
Land . . . . .	\$ 3.00	\$ 3.00	\$ 0.15	\$ 1.20	.....	.....	.....
Buildings and equipment . . . . .	20.00	10.00	0.50	.....	.....	.....	.....
Feed and supplies . . . . .	1.00	1.00	0.05	.....	.....	.....	.....
Rabbit stock . . . . .	8.00	8.00	0.40	.....	.....	.....	.....
<b>Total</b> . . . . .	<b>\$ 32.00</b>	<b>\$ 22.00</b>	.....	.....	.....	.....	.....
Total depreciation . . . . .	.....	.....	.....	\$ 1.20	.....	.....	.....
Total interest on investment . . . . .	.....	.....	.....	\$ 1.10	.....	.....	.....
<b>Total annual depreciation and interest</b> . . . . .	.....	.....	.....	.....	.....	.....	.....
Other annual costs (feed, labor, etc.) . . . . .	.....	.....	.....	.....	\$ 575.00	\$ 2.30	2.2
<b>Grand total annual costs</b> . . . . .	.....	.....	.....	.....	<b>\$ 6,767.00</b>	<b>\$ 27.07</b>	<b>25.6</b>
Assumed income from 26,450 pounds at 29 cents per pound . . . . .	.....	.....	.....	.....	<b>\$ 7,342.00</b>	<b>\$ 29.37</b>	<b>27.8</b>
Management income † . . . . .	.....	.....	.....	.....	<b>\$ 7,670.50</b>	<b>30.68</b>	<b>29.0</b>
Farm income ‡ . . . . .	.....	.....	.....	.....	<b>\$ 328.50</b>	<b>\$ 1.31</b>	<b>1.2</b>
					<b>\$ 2,793.50</b>	<b>11.17</b>	<b>10.6</b>

\* Derived from Southern California Rabbit Management Study, 1947, but estimates still very reasonable.

† Management income is total income less all costs, including the value of the operator's labor and 5 per cent interest on the investment.

‡ Farm income is defined as labor and interest plus management income. In this case, labor, \$2,190.00; interest, \$275.00; management, \$328.50.

## STANDARD OF EFFICIENCY . . .

A plan of production depends on the goal. The possibilities of success depend on the costs of land and equipment, breeding stock, feed, and mortality, in relation to returns from the sources of income, plus the very important factor of dependable markets and the somewhat less important factor of favorable weather.

What the average net farm income may be over a period of years or for any one producer is a variable figure. An analysis of the records shows certain standards of attainment accomplished for separate items, but no one producer has attained a total standard of efficiency.

There has been a decided increase in efficiency in recent years, especially in the annual number of pounds of meat rabbits raised per doe, although mortality for mature does is still high. With figures based on the Southern California Rabbit Management Study for 1947, certain conclusions may be drawn.

**Minimum goal.** About 250 does are considered the minimum goal for a full-time one-man business. A rabbitry of this size would call for an average investment of \$5,500. An operator working 8 hours a day for 365 days—spending 2,920 hours yearly in management—would net a farm income of about \$2,793 if fryer rabbits sold at an average of 29 cents a pound. Other producers, working under different conditions, should figure their farm income according to existing prices. The investment per doe in 1952, considered standard for a new enterprise, was roughly estimated at \$32.00 (table 12). The more efficient rabbit raiser can take care of 300 to 350 breeding does or even more, as many as 500 to 800 being possible.

The range in number of pounds of live fryer rabbits produced per doe has varied considerably. This is due, in part, to the difference in number of litters per year and in mortality. With an average of 7.5 young per litter, and four litters a year, a doe may produce 30 young a year; but with 20 per cent mortality among the

young, the net number raised is estimated at about 23.5. A goal of 25 fryers raised per doe is reasonable.

In actual practice, it takes about 1.2 breeding animals for replacement. In 1951, Los Angeles County reported 28 rabbits raised per doe; in San Bernardino County the average number was 25.2 rabbits. This average is probably above the general state average. There should always be a sufficient number of young breeding animals coming along to replace the nonbreeders and poor producers which must be culled. For every 100 working does, 120 must be raised each year to maintain the herd. Management of this kind is what is meant by having a goal.

**Study of the unit.** It is a good thing for an operator to study his unit for more profitable use of any spare time. In some instances, it may be best to discontinue the raising of rabbits. If an increase in the size of the rabbitry is indicated, certain marketing problems will have to be handled. Greater emphasis may be needed on any one, or two or more, of the sources of income.

With all of these possible sources of income put into effect, the average labor income may be considerably increased. An allowance of \$1.00 per hour for labor is not an unreasonable amount at present (1952).

**Financial reserves.** It is essential to attempt to build financial reserves in years of low prices. These will enable an operator to tide over until prices improve. There are always some producers who make more than the average return, because of low feed cost or good management, or both; and there are also produc-

ers who make only a small labor income or possibly barely meet the cash outlay. At least a fair return is essential or the business will suffer. Whether the business is a success or a failure is decided by the

combined income from meat, pelts and furs, wool, breeding stock, and such miscellaneous sources as manure and sale to biological laboratories, less the cash costs, interest, and depreciation charges.

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In order that the information in our publications may be more intelligible, it is sometimes necessary to use trade names of products and equipment rather than complicated descriptive or chemical identifications. In so doing, it is unavoidable in some cases that similar products which are on the market under other trade names may not be cited. No endorsement of named products is intended nor is criticism implied of similar products which are not mentioned.

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